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THE SOCIETE INTERNATIONALE DES ELECTRICIENS.

Elsewhere will be found the second of a series of articles descriptive of the more important national electrical engineering organizations of the world, which article, like that in our issue of June 30, 1910, on the British Institution of Electrical Engineers, will repay careful reading by members of our similar national bodies. While the French body differs in many respects from its prototype across the Channel, like the older organization its conduct has uniformly been characterized by professional dignity and adherence to high professional ideals. Like the older body, also, it has a system of nomination for office removed, so far as appears possible, from the machinations of politics. While the method of nomination pursued by these two bodies undoubtedly places their direction with the real leaders in the electrical field, it is questionable whether the same plan, owing to its somewhat undemocratic character, would succeed if applied in this country. For our conditions the method of selection by a board of nominators, such as is provided for in the constitution of the Illuminating Engineering Society, accomplishes practically the same end, and appears preferable in at least one respect, namely, that the board, consisting of the two junior past-presidents and a past vice-president representing each geographical section of the society, changes each year in personnel with the exception of one member, thus tending to make its deliberations more responsive to the spirit of the times as interpreted by those who so very recently carried on the work of the body.

The French society is unique among professional engineering organizations from the part it has taken in directly forwarding the interests of electrical science and the electrical art by the establishing of a testing laboratory and a technical school. France, unlike England, is not open to reproach for neglect of the technical sciences, so that the society was not forced to act in the premises by a fear that otherwise these interests might be indefinitely ignored. Instead, however, of waiting on the usual course of evolution, as soon as the need of electrical laboratory service and special electrical training became evident, it vigorously directed its activities toward supplying that need concretely, instead of resting content with recommending action on the part of other agencies. It would, however, appear hazardous for one of our professional bodies, owing to the shifting nature of their government, to undertake a similar task. The achievements of the French society will probably remain unique, but none the less will serve as a shining example of the exceptional work that professional organizations can accomplish when under wise and stable government and conducted with serious purpose.

A CHEMICAL SPECIFICATION FOR RUBBER INSULATING MATERIAL.

Pure rubber, as refined from the raw product of the tropical forest, is a fairly definite commercial substance, although its chemical composition is complex. If wires and cables were insulated with pure rubber it would be comparatively easy to

define, by specifications and tests, the nature and qualifications of the material. But for good practical reasons, and among them the need of vulcanization, pure rubber cannot be used for the entire coating of insulation. It is generally considered desirable that one-third of the weight of the insulating material shall be rubber and that the remaining two-thirds shall be non-rubber, or filling material, including sulphur for vulcanizing. It is manifest that the specifications for the chemical qualities of a material called rubber, which actually is at best only one-third rubber, are not made easier by the presence of the filler. Moreover, the chemical tests for the rubber in the material are difficult, and depend upon the technique adopted, so that rubber analyses of the same material by different chemists are likely to differ considerably. The article by Mr. C. R. Boggs which we print this week will be useful to engineers having to deal with rubber-covered cables, by supplying a definite and practical schedule of chemical tests with a clearly detailed technique Such a schedule, if agreed to and adopted both by manufacturers and purchasers of rubber-covered wires, would assist them in arriving at a mutual understanding.

DIVERSITY FACTORS.

The subject of diversity factors is one of special importance with respect to residence lighting and load of similar character in which the connected loads and possible maximum demands of the individual consumer are high compared with the normal consumption of energy. It has long been well known that the conditions of residence lighting are such that the ostensible maximum demand, either reckoned from the connected load or obtained by measurements, has no such effect upon the capacity of plant required by the consumer as is found in other classes of work where the maximum demand, or something very near it, is frequently for considerable periods maintained. A paper by Mr. H. B. Gear, recently abstracted in these columns, throws a flood of light on this particular problem. In it is shown by actual analysis of typical groups of residence consumers that in this class of lighting the actual maximum demand of a group may be expected to be about one-third of the sum of the individual maxima of that group and about one-fifth of the total group load. In other words, for this class of work the generator and the transformer capacity need be only about one-fifth of the connected load and one-third the sum of the individual maxima.

This shows a surprisingly low diversity factor for the grouping of consumers who, *a priori*, would be expected to have very similar habits of consumption. It shows, moreover, that if consumers of this class were charged on the basis of the individual maximum demands they would be overcharged in a very large ratio considering the character of the group demand. How large this difference might be expected to be is shown by Mr. Gear's figures on commercial lighting of the smaller sort, in which the diversity factor is just about one-half that found in residence lighting. In other words, the station has to reserve for the work of the residence group only about half the capacity which it has to reserve for a group of small commercial consumers having ostensibly the same individual maximum demands. It is really curious to find so great a diversity factor in residence work, but it seems to be now thoroughly well established and must be borne in mind in the organization of any system of rates intended to be fairly applicable to this class of work. It looks very much as if the residence consumer were on the whole a much better customer as regards his demands upon the station than has generally been admitted.

Mr. Gear makes a further important contribution to the subject in the analysis of the costs of equipment for supplying several classes of customers on the basis of the application of the diversity factor. Basing his comparison on the cost of equipment, including generation, distribution and metering per kilowatt of load on the generating station, he finds that for the residence-lighting group this cost is about $440, while for the small commercial customers it is about $354. This takes account of the diversity factors of the two classes, but it does not take account of another very important matter, namely, the relation of the system capacity to the system load in the two cases respectively. Commercial lighting is essentially peak lighting. Residence lighting is to a very large extent off-the-peak lighting. At least it seems to be well established that the pure residence peak comes on considerably later than the commercial peak, as might be expected from the relative conditions in the two classes of service, and hence the residence consumer makes a considerably smaller demand for total installation capacity than the average for the system.

We hope that Mr. Gear, or some other investigator with similar facilities for obtaining the data, will make it his business to analyze the matter from this particular standpoint and find out what proportion of the total residence output falls at such time as to increase the general peak load. For a guess, it would seem probable that only something like half the residence aggregate demand would go to increase the general afternoon peak, a fact which has a very material bearing on the desirability of residence load as such in a system doing general business. Any disparity of this sort goes far to modify the costs just given as bearing upon the standby conditions. To analyze these costs a little further, Mr. Gear found that of the $440 per kilowatt of generating station load required in the residence work, $124 was charged up for consumers' meters as against $38 in the commercial lighting group. It seems somewhat startling to realize that almost one-third of the total investment in the former case falls to the share of meters, and, as Mr. Gear intimates, it emphasizes the desirability of a less expensive type of meter which would serve for the smaller classes of consumers. Metering in itself is a logical and desirable thing, but if Mr. Gear's figures are typical they furnish a somewhat strong argument for the flat-rate scheme as carried out in Hartford and some other places. The obliteration of an investment charge of nearly 30 per cent of the total, with its corresponding maintenance charges, would certainly go far to offset the moral hazard which is undeniably the chief objection to a flat rate. Abolishing the meter investment would bring the charge figured by Mr. Gear for residence work materially lower than that for the small commercial work; indeed, wiping out the meter charges in both cases would leave them upon a parity. We presume that these meter charges are based upon actual figures at hand, although they seem for the residence consumers, and particularly considering the small connected loads, rather disproportionately large.

We hope that his very striking and able investigation will lead to a further study of the matter. It looks very much as

though analysis of the situation, both with respect to diversity factor and to amount of peak demand, would leave the residence consumer rather in the odor of sanctity than in the condition of a pariah which he at present seems to occupy in the minds of many central-station men. He is certainly not despised by the gas companies, since he is one of their large assets; and the electric central stations might find that it would be wise to profit by the example of their rivals in cultivating this class of business to a far greater extent than has been usual.

ALTERNATING-CURRENT NOMENCLATURE.

In a recent number of our Parisian contemporary, *L'Industrie Electrique*, M. Brunswick raised the question as to what name should best be applied to the quadrature component of voltage, current, or power, in an alternating-current circuit. A French adjective in common use for this purpose is "dewatté," corresponding to our own term "wattless." M. Brunswick attacked this term vigorously, not only on the score of inaccuracy and impropriety, but also on the score of faulty grammatical construction. Several suggested terms were offered by him for substitutes, and among them "potential" current, voltage, or power. M. Brylinski, in a subsequent communication to the same journal, suggested that the term "reactive" might advantageously be used, but criticised adversely the use of "potential" in this connection. M. Boucherot, in another communication, also objected to the use of "potential," but suggested several substitutes, among them "compensé" and "magnetizing." He also suggested the desirability of arriving at an international term through the good offices of the International Electrotechnical Commission. As we have ourselves pointed out on various occasions, the term "wattless" component of current, voltage, or power, is very misleading, because it naturally suggests that the said components are devoid of all power. In point of fact, it is well understood that "wattless power," for example, is just as much power as "real power" in an alternating-current circuit, except that the former is retained within the circuit, or merely moves to and fro within the circuit, whereas the latter is liberated from, or disappears from, the circuit. A term is, therefore, needed as a substitute for "wattless" which shall not contravene the actuality of power in the quadrature component, but which will clearly distinguish between the externally effective component and the quadrature component, which reacts only on the circuit.

In our correspondence columns this week Mr. C. O. Mailloux draws attention to the important consideration that whatever term is selected should preferably be capable of use in all the principal languages of Europe. He shows that since the term "reactance" is in international use a term based upon this word would be very suitable. In this we agree with him entirely, except that, as a matter of detail, we believe that the term "reactive" voltage, current, or power, would be somewhat preferable to "reactance" voltage, current, or power. If "reactive" were adopted, the term "reactance" would be a self-explanatory alternative, when desired. It seems as though in dealing with resistances the real component is generally called the "effective" resistance, the quadrature component the "reactance," and the vector sum of the two the "impedance" or "apparent" resistance. That being the case, it seems very natural to select for the corresponding components of the current, voltage, or power, the terms "effective," "reactive" and "apparent" throughout the series. We should then have, in all languages, the apparent resistance, voltage, current, or power, subdivided into an effective component—i. e., a component effective in producing dissipation from the circuit—and a reactive component. Of course, the term "reactive component" does not indicate whether the said component is leading or lagging with respect to the phase of the standard quantity in reference. In order to meet this need we might use the terms "leading reactive" and "lagging reactive."

We hope that the examples of MM. Brunswick, Boucherot and Brylinski abroad, as well as of Mr. Mailloux over here, will be followed by others interested in clear and accurate terminology, who may have further suggestions to make. The proposition to standardize terms internationally among different languages suggests the possibility of standardizing terms and orthography in different branches of one and the same language. Mr. Mailloux mentions the well-known precision of the French language, and the care which the Académie Française exerts in maintaining the standard of that language. It is generally admitted, in fact, that the well-recognized grace, force and precision of the French language are owing in appreciably, if not in considerable, measure to the labors of the said French Academy, which is charged with the duty of standardizing it. There is only one authoritative dictionary of the French language, and that is periodically issued under the auspices of the Academy. Such a body may be very conservative, and may even retard progress; but, at least, it has the merit of maintaining a single standard of good literature on a uniformly high plane.

In this direction the English-speaking peoples are far behind the French. We have not only already permitted distinct small differences in orthography to appear in well-recognized English and American literature—for example, "honour" versus "honor" and "centre" versus "center"—but we are giving countenance to sporadic attempts at more or less discordant efforts toward simplified spelling, which not only tends to disrupt the English and American literatures yet further, but also to perplex the youthful student and to set a premium on the untrammeled laxities of illiteracy. All impartial observers will admit that there is need for reform and improvement in English orthography; but it would be far better, both for ourselves and for the cause of civilization, to continue in one and the same universal orthography, without any simplification and reform, than that our own English-speaking nation should adopt a reform while the others do not. All such reforms in written language should be made collectively. At a distance of several thousand miles the tie of an absolutely uniform literature and written language is of the first importance and power. It would, therefore, be of great importance and value to the English-speaking countries, as well as to all other countries coming into contact with the English language, that an international English conference should be called, say, in England, with the purpose of establishing a permanent commission having large powers confided to it in the direction of standardizing English orthography and orthographic reform. If such a body issued a dictionary every ten years we should have means of knowing definitely, at any time, what was good English and what was not. At present we have to depend upon the majority among a number of dictionaries.

Interstate Commerce Commission Regulation of Telephone and Telegraph Companies.

The Interstate Commerce Commission has called a conference for Dec. 7 at Washington of representatives of the telegraph and telephone companies to consider the scope of the paragraph of the new Interstate Commerce Law regarding these corporations. The questions to be considered relate to the determination of the companies that are subject to the act to regulate commerce; to ascertaining if these companies can issue franks for interstate service, and to deciding if these companies are required to file their tariffs of charges.

Certain questions bearing on the relation between a local state company and an interstate company will be discussed. Among them will be these: "If a state company receives a message at a point within the state, for transmission to a point without the state, which it transmits over its lines to another point in the state and there delivers to an interstate company for transmission to destination, is the state company, by virtue of its participation in this transaction, made subject to the act?" and "A state company and an interstate company have switchboard connection. If the two lines are connected so that a person within the state talks with a person at a point without the state, or so that a message is transmitted directly from a point within the state to a point without the state, does that amount to interstate commerce which brings the state company within the purview of the act?"

Opening of American Museum of Safety.

The formal opening of the American Museum of Safety occurred on Monday evening, Nov. 21, in the auditorium of the Engineering Societies Building, President Philip T. Dodge occupying the chair. A letter was read from President Taft in which he expressed his interest in the work of the American Museum of Safety. The whole civilized world, he said, was stirred with anxiety and the hope for the adoption of those safety devices which will prevent the loss of life and limb in industrial pursuits, and he knew of no method of bringing about the use of these devices more effectively than in their exhibition in such a museum as that being established. Ex-Governor Hughes also sent a greeting in which he said that at the outset he had been much interested in the work of the museum, because of the appalling number of accidents seemingly preventable and the importance of directing public attention in every possible way to all precautionary means and appliances which may be feasible. He congratulated the officers upon the progress already made in the development of the museum and hoped that through the opportunity it affords for the exhibition of devices and through the interest thus aroused the measure of protection to life and limb will be greatly increased.

Mr. C. S. Dunham, president of the Travelers' Insurance Company, then presented the gold medal offered by his company to the individual or corporation that has done most for the protection of the lives of the workmen by means of safety devices upon machines and processes. The recipient was the United States Steel Corporation, on behalf of which the medal was accepted by Mr. W. B. Dickson, first vice-president. Prof. F. R. Hutton, chairman of the jury of awards, announced that the trustees had awarded the *Scientific American* gold medal for the best safety device exhibited at the museum to the Safety Scaffolding Company for its design and construction of a suspended platform. He pointed out that with the old style of cantilever platform with horses the falls of men from buildings and scaffolds in New York in the five years preceding 1909 numbered 660, of which 177 were from scaffolds. During the last two years 267 buildings have been supplied with scaffolds by the above company and at least 6300 men have worked on them without the loss of a single life. Dr. W. H. Tolman, director of the museum, who spent the summer abroad studying the German system of accident prevention, showed how Germany is reducing the accidents to labor by about 50 per cent. He said that during the last twenty-five years Germany has spent upward of $2,500,000,000 preventing accidents, restoring wage-earning efficiency to sick and wounded workmen and in compensation to their families. Mr. T. C. Martin, chairman of the executive committee, said that the present exhibition hall is already outgrown and valuable exhibits are being turned away for lack of room. Two adjoining halls are available for this overflow, for the library, lectures and demonstrations if the money can be provided. Twenty-five thousand dollars is required for this much-needed expansion, and every dollar contributed would, he said, be the means of saving human life. Mr. Edson S. Lott, president of the United States Casualty Company, speaking for the casualty companies, and Dr. N. E. Ditman, chairman of the Department of Sanitation, gave their respective reasons for believing in the high value of the work which the museum is accomplishing.

Some Features of the Forthcoming Chicago Electrical Show.

About sixty-five exhibitors have entered into contract to take space at the next Chicago Electrical Show, which will be held at the Coliseum on Jan. 7 to 21, 1911. As many of the exhibitors are taking larger allotments of space than at the last show, the amount of space remaining unsold is comparatively small, and it is believed that by the time the show opens space will be at a premium.

The general scheme of interior decoration and lighting will be different from anything heretofore attempted. It will represent a noonday effect, the ceiling of the large building being treated and lighted to represent a bright daylight sky with a few fleecy clouds. Consistent with this conception will be the placing of all exhibits under vine-covered trellises, giving the appearance of arbors. A 500-watt tungsten lamp will be suspended from the arbor over the center of each exhibit space and smaller tungsten lamps will surmount the posts connected with the railing surrounding the exhibits. D. H. Burnham & Company, the architects, are designing the decorations.

As in former years, the central-station exhibit of the Commonwealth Edison Company will form a conspicuous feature of the show. The space at the north end of the building heretofore allotted to this company will be used again. The idea of this year's Edison display will be a representation of a section of a street with a 7-ft. sidewalk, street lamps and six stores. The street lamps will consist of six posts, each supporting four or five 60-watt tungsten lamps in round frosted-glass globes. These posts are of the type adopted as standard for the various special street-lighting installations in Chicago.

Commonwealth Edison Avenue is the name given to this "street," and each of the stores fronting on it will be of fairly good size, with two show windows and a central entrance. The stores also communicate with one another. One of them will be a lamp shop, displaying handsome portable lamps and ornamental fixtures, as well as artistic lighting arrangements and attachments of all kinds. This store will also serve as a reception room and will be handsomely fitted up. Another store will be a model grocery. All kinds of staple groceries may be seen here and the various applications of electricity in a retail establishment of this kind will be exemplified.

A third store will be a shop for the display of domestic electric appliances of all kinds, as washing machines, sewing-machine motors, vacuum cleaners, electric toys and a variety of miscellaneous appliances for domestic use. Still another store will be given over to men's furnishings and its neighbor will be devoted to a millinery display. In these two stores especial pains will be taken with the lighting effects, and with the bright-hued fabrics and modish articles of wearing apparel, the display will be decidedly attractive to both ladies and gentlemen. In all the stores especial attention will be paid to show-window lighting, which will be varied to suit the different requirements of the goods displayed. A prominent electric sign will surmount the whole exhibit.

Meeting of Rate Committee, New England Section N. E. L. A.

At the New London convention of the New England Section of the National Electric Light Association it was decided to take up the question of central-station rates by committee investigation and report to the annual meeting of the section in the spring of 1911. The committee held its first meeting in the Edison Building, Boston, on Nov. 12, for the purposes of organization. Mr. Donald C. Barnes, Pawtucket Electric Company, Pawtucket, R. I., was elected chairman, and Mr. E. C. Newman, of the Concord Electric Company, Concord, N. H., was chosen secretary. The other members of the committee are Messrs. W. B. Bragdon, Presumpscott Electric Company, Waterville, Maine; George S. Haley, Rutland Railway, Light & Power Company, Rutland, Vt.; L. R. Wallis, Edison Electric Illuminating Company, Boston; A. T. Holbrook, Excess Indicator Company, New York, and C. A. Learned, Meriden Electric Light Company, Meriden, Conn. In response to requests for information concerning rate practice considerable data have been sent in to the office of the New England Section in Boston from various central-station companies represented in the association. The committee examined the information received and had an informal discussion of the accumulation of further material for its report. Other meetings will be held later.

Electric Wiring Regulation in Louisiana.

In 1910 the Louisiana Legislature passed an act authorizing municipalities of the State of over 25,000 inhabitants to regulate "persons, firms and corporations installing wires or apparatus conveying electric current for light, heat or power." The act provides that laws and ordinances may be enacted in furtherance of its provisions. The Mayor, with the consent of the Council, is authorized and empowered to appoint a board or commission, to be composed of not more than five members, of which the city electrician shall be a member and chairman, provided that the remaining four members shall be electricians who have had five years' experience as such; and the municipalities may, in their discretion, vest the board with full power, control and regulation. It is provided, however, that the power of final inspection of any of the work shall be absolutely in the hands of the city electrician. The municipalities are also authorized to provide methods of punishment for infractions of the rules it may create.

In 1908 an act was passed creating a state board, to be appointed by the Governor, but soon after its provisions had been put into force the act was declared unconstitutional by Judge Chretien, of the Criminal District Court for the Parish of Orleans, in the case of the New Orleans Electrical Board of Examiners versus Gantz. The act of 1908 was never taken up to the Supreme Court of Louisiana.

The Mayor of New Orleans has appointed Messrs. Foster Olroyd, city electrician; I. G. Marks, J. W. A. Richardson, Walter Dilzell and Henry Miller—the latter secretary of the local Electricians' Union—as commissioners. Messrs. Dilzell and Miller are the only members of the former State board who are appointed on the new board. The ordinance provides a charge of $50 for license, payable before examination for fitness by the board, with an annual renewal fee of $25. A bond for $2,500 is required.

All electrical work done by persons, firms or corporations representing themselves as engaged in the business must be under the personal supervision of a representative who has qualified by complying with the regulations. An applicant failing to pass the examination before the board of commissioners receives a second opportunity and, if successful, pays $15 instead of the fee of $50. The bond is to secure action against a defaulting contractor by the real party in interest, which action must be begun within six months after the completion of the work so done.

Inspection and approval by the city electrician, according to this ordinance, fulfils the requirements and releases the contractor from obligation. To continue in business electrical firms and corporations must qualify within sixty days from the passage of the ordinance. Provision is made for the transference of certificates held by a concern whose representative has passed the required examination. The law is essentially the same as the State act of 1908, the full terms of which were published in the *Electrical World* of Aug. 15, 1908, except that the clause exempting the New Orleans Street Railways Company is omitted.

Lightning Phenomena Under Investigation at University of Illinois.

In the effort to devise better means for the protection of buildings against lightning the Engineering Experiment Station of the University of Illinois, at Urbana, Ill., is conducting an interesting investigation. In a large open field twelve 40-ft. poles have been erected. Six of these have been equipped with devices for indicating the effect of lightning strokes at or near these poles. The investigation was begun last spring, and during the summer of this year there were very few storms accompanied by lightning, and none of the poles were hit. However, indications were given of the effect of lightning strokes at a distance. It is planned to add special recording devices to the present equipment and to continue the tests.

When complete the apparatus will consist of a series of spark-gaps shunted by resistance, inductance and capacity in series. The lightning may jump across the gaps or pass around them through the shunt circuits. Any action due to lightning will be recorded on a moving strip of paper driven by clockwork, so that the exact time of the electrical discharge can be told from the record.

Three of the poles have been equipped with sharp needle points and three with 6-in. brass balls. The first points were of steel and rusted badly. Silver-plated points were substituted, but they rusted nearly as quickly as the first set. On inspection all the points were found to be bent over, as if softened by heat. Moreover, all were bent so that they pointed to the northeast. There seems to be no adequate theory to explain this curious phenomenon. The work is being carried on by Mr. T. D. Yensen, of the Engineering Experiment Station Corps, Department of Electrical Engineering.

Building for Chemists' Club.

The Chemists' Building Company, organized by members of the Chemists' Club, New York, has erected a ten-story fireproof building, on a lot 56 ft. wide and 100 ft. deep, at 50-54 East Forty-first Street, New York City. The lower half of the building is leased to the Chemists' Club and contains all the conveniences for a social club, together with a large auditorium for scientific meetings and ample space for a complete chemical library and museum.

The five upper stories have been specially constructed for laboratory purposes and will be rented either as entire floors or in suitable subdivisions to analytical, commercial or research chemists, physicists, electrochemists, bacteriologists, etc., but not as manufacturing laboratories. This section is provided with ventilating flues, water, gas and electric mains, steam and compressed-air lines in suitable locations, but the tenants will make their own connections and provide their own fixtures.

Rental will include janitor and elevator service, heat, and electricity for lighting purposes, and the company will construct proper partition walls for the subdivision of the laboratories according to the tenants' wishes. It is intended to charge low rentals and in many ways facilitate the prosecution of scientific and industrial research.

Underwriters and Electric Wiring.

Mr. W. J. Canada, electrical engineer of the Rocky Mountain Fire Underwriters' Association, gave a talk on Nov. 11 on the "Influence of Underwriters on Electric Wiring" before the student branch of the A. I. E. E. at the Colorado State Agricultural College. He stated that insurance was developed by mathematicians at the same period as the laws of probability were first formulated, and that insurance remains to-day the only commercial application of these laws. The gradual introduction of fire-hazard measurement by analytic methods was discussed, and the present detailing of probability into individual causes, including wiring defects, was noted.

In discussing the present standard of electric wiring Mr. Canada said that the remaining problems include better specifications for rubber insulation, better cut-out cabinets, elimination of cords, mandatory conduit installations, etc. The growth of municipal and state restrictions is securing much needed uniformity, but permanency is still lacking in construction methods. Mr. Canada considers that the opportunities for the technical graduate in this field of work appear to be excellent, as it is by the application of trained minds and liberal methods that the various problems remaining will be worked out.

Addition to Minneapolis St. Croix River Plant.

The Minneapolis General Electric Company has just installed the third pair of 2500-kw waterwheel-driven generators in its Taylor's Falls plant on the St. Croix River, and is completing a second transmission line to convey the additional energy into the Minneapolis substation, where new equipment has also been installed. The Taylor's Falls plant utilizes a head of 65 ft. and is designed to contain eight 2500-kw generators, six of which are now in place, while the wheel pits for all eight are complete. A description of the hydroelectric development of the Minneapolis General Electric Company was published in these columns July 6, 1907. The 50,000-volt line connecting the station with Minneapolis was described in the issue of Sept. 7, 1907, and the receiving station at Minneapolis was illustrated and described in the Oct. 5, 1907, number.

Development of Coon Creek Rapids Near Minneapolis.

The Great Northern Development Company, of Duluth, Minn., which under the direction of Mr. F. A. Cokefair, chief engineer, constructed the Thomson Falls hydroelectric plant on the St. Louis River, furnishing electricity for Duluth and Superior, Wis., has prepared plans for the development of the Coon Creek Rapids in the Mississippi River, six miles above the City of Minneapolis, where about 12,000 kw will be available. The company now owns all of the site and the overflowed lands, and will erect a dam impounding water for six miles upstream to Anoka as soon as permission is granted by Congress for the use of the river. This Coon Creek plant will be the first, it is thought, of an extensive system of hydroelectric development recovering a total of 200,000 hp from the St. Louis and upper Mississippi Rivers.

120,000-hp Mississippi River Hydroelectric Plant.

The Keokuk & Hamilton Water-Power Company, which some time ago began the construction work for a power dam across the Mississippi River at Keokuk, is now starting the legal work of taking up its options on the land which will be overflowed by the large lake formed above the dam. These options expire Dec. 31, 1910. It is estimated that the complete installation of the power plant will cause the flooding of about 15,000 acres, and that the overflow will ultimately extend to a distance of sixty-five miles north of the dam. Options were secured on 60 per cent of the lands to be flooded before construction work was begun. The remainder will be secured by purchase from owners before the gates are actually closed and the water raised, as it is not thought that condemnation proceedings will be necessary. In addition to buying overflow rights the company will supply a new right-of-way for the C., B. & Q. Railroad track, in so far as its present roadbed will be overflowed, which will be for about twelve miles.

The company is now employing about 150 men in its work on the Hamilton side of the river, and will shortly put on fifty more. New equipment in the way of cement-making machinery and small locomotives and dump cars is being ordered. The only change in the construction plans as first announced is that the initial installation as now contemplated will be 120,000 hp instead of 100,000 hp.

A statement in a recent note in these columns that the Keokuk & Hamilton River Power Company contemplated erecting a second plant above Fort Madison has been denied. Owing to the wide bottom lands and lack of head a hydroelectric plant at Fort Madison would, it is stated, not be a possibility.

United States Navy Standard Specifications for Motors and Their Controlling Appliances.

The United States Navy Department has recently adopted a very progressive policy in the standardization of its specifications for electric motors and their controlling appliances for use on shipboard and also at the various yards and stations on shore.

Prior to the adoption of the present standard specifications the different technical bureaus of the Navy Department, of which there were formerly five, each purchased motors under specifications of its own choosing, which specifications differed sufficiently one from another to make apparatus for the same purpose materially at variance, depending upon the bureau by which it had been ordered. The result must necessarily have been to decrease the desirability of navy business from the standpoint of the manufacturers and increase the cost of this material to the government.

The Bureau of Construction and Repair of the Navy Department was active in this work of standardization, having promoted the adoption of uniform specifications by means of representative conferences. The specifications were prepared for the consideration of the conferences by the expert electrical aid of the Bureau of Construction and Repair, Mr. M. W. Buchanan. In addition to officers and engineers from the different bureaus of the Navy Department the conferences included representatives from a large number of the principal American motor manufacturers and from the American Association of Electric Motor Manufacturers. The object in view was to make the specifications broad in their scope and as liberal as is consistent with the best American practice.

The following specifications have been standardized in the manner above outlined, and have been issued by the Navy Department for the use of all bureaus of the department:

Specifications 17-M-1.—Direct-current motors for operating navy-yard machinery, issued Sept. 3, 1909. Specifications 17-M-2.—Induction motors for operating navy-yard machinery, issued Sept. 3, 1909. Specifications 17-A-3.—Auxiliary electrical appliances on shipboard, issued Oct. 26, 1910.

The two first-mentioned groups of specifications are intended to cover first-class commercial motors for general power purposes on shore. The third group of specifications is intended to cover the highest grade of motors obtainable, in which special features of construction and materials are required, having in mind the more severe nature of marine service and insurance for military preparedness.

The standardization of motor specifications is a movement in the direction of uniformity and economy in the purchase of material for the Navy Department, which was the subject of comment in an article of the *Electrical World* of June 23, 1910, entitled, "Electrical Engineering in the Navy."

Rational Basis for Telephone Rates.

In a paper read by Prof. D. C. Jackson before the National Municipal League, at Buffalo, N. Y., on Nov. 15, the subject of telephone rates was discussed in detail with special reference to the differences between the various classes of customers served by a telephone company. The author stated that a telephone company must sell service, which is more difficult to accomplish satisfactorily than the sale of commodities. On account of the wide range of service customers are grouped as residence subscribers, business subscribers, private branch exchange subscribers, special-line subscribers, party-line subscribers, etc.

Prof. Jackson said that the ideal method of charging for telephone service is to charge each customer in proportion to the service he receives from the company, measured in quantity received, this service to be of the quality corresponding to his needs, and to make the charge to all customers as low as is consistent with the operation and maintenance of the property, accompanied by a fair return on the money invested.

The cost of performing the service must be given cautious consideration. For example, in city service the large business users demand a celerity and accuracy for the service which adds much to its cost. Physical conditions prevent providing fast service for one class of subscribers and not for others in intimate intercommunication therewith. However, some of the latter classes, as, for instance, the residence users of moderate means, may have no interest in or care for the remarkable speed and accuracy which characterize the telephone service of many American cities. Service of a lower grade of speed and accuracy, which is less costly to produce, would equally well satisfy the desires and needs of such subscribers. A distinction should, therefore, probably be made in class rates, so that the cost of extraordinary speed and accuracy may be placed on the classes of subscribers who demand it.

A similar condition exists in the relations of city and rural telephone service. The business subscribers of the city demand the speediest and most accurate service obtainable at any cost, but rural subscribers are usually well satisfied by a more leisurely grade of service. However, the city conditions are forced, by the demands of the city, to be spread over both the city and the closely related rural communities; here again the extra cost of the speedy service ought to be borne by the classes of subscribers imposing it. As the provision of the speedier service requires greater investment in rural plant than might otherwise be necessary, it is obvious that the cost of performing specific service in the suburban communities may not always be a fair basis of rates in case the cost is to be put where it belongs.

The foregoing indicates that city business rates may be reasonably expected to be higher than residence or rural rates. A differentiation between business and residence users under flat rates has heretofore been common, and this is additionally justified by the lower average calling rate which is usually characteristic of residence service where flat rates are in vogue.

The relations pointed out above apparently justify an adjustment in favor of residence users of moderate requirements even when measured rates are adopted. The policy of some telephone companies apparently is in this direction, although those companies have endeavored to support their policy on the untenable theory of charging in proportion to what the traffic will bear. Few telephone companies can support the reasonableness of their schedules on a foundation of facts produced from their accounting records, but this condition is likely to be overcome.

Prof. Jackson remarked that the willingness of the telephone companies to co-operate with supervisory commissions in gathering and to some degree in studying cost and traffic statistics is an encouraging indication. With accumulating statistics, which give a clearer understanding of costs of giving service and the relation of speed and accuracy of service to its costs, each modification of schedules under the supervision of wisely constituted commissions ought to approach closer to a rational basis.

Professor Merriam on Municipal Problems.

The work of Prof. Charles E. Merriam, Alderman from the Seventh Ward in the City Council of Chicago, is attracting attention. Mr. Merriam is professor of political science in the University of Chicago and the author of several books on his specialty. Since his election as Alderman he has taken his duties in earnest, and the Chicago Commission on City Expenditures (commonly known as the Merriam commission), of which he is chairman, has performed a useful service in investigating the various departments of the city government in a fair and judicial spirit. Prof. Merriam is also a trustee of the new Bureau of Public Efficiency, which is the logical outcome of the investigations of the Merriam commission. The work of the commission is still unfinished, but a number of its reports have been made public, that on the Department of Electricity being recently summarized in this journal.

At the recent annual dinner of the Chicago Association of Commerce Professor Merriam was one of the speakers and his remarks were important and interesting. Speaking of the transportation question, he said: "We now need not only through routes, but consolidated service on surface lines. We need a system of subways to relieve the intolerable congestion in the Loop district. We need consolidation of elevated lines and consolidation of elevated and surface lines. We need closer co-ordination between the transportation services rendered by the elevated and surface lines and by the steam railways. There is need for the adoption of an electrification policy for railroad lines and for systematic and vigorous treatment of the railroad-terminal problem in its entirety."

Speaking in more general terms this modern type of alderman declared himself as follows:

"The affairs of American cities have reached a point where the amount of money expended and the importance of the work performed make it absolutely imperative that a new type of municipal government be established. People are weary of the grafter and the near-grafter. They realize that there has been too much trifling with the eighth commandment, and insist upon higher standards of civic integrity. Not only is this true, but many sides of municipal administration have become specialized branches of work, requiring special abilities and training.

"The city should provide a proper method of service regulations. It should create a bureau of public utilities, properly equipped technically to deal with questions of service and ready to supply such data as may be required by the City Council for the purpose of the periodical revision of the public-utility rates."

Convention of National Society for Promotion of Industrial Education.

The fourth annual convention of the National Society for the Promotion of Industrial Education was held at Boston from Nov. 17 to 19, inclusive. It was largely attended by educators, publicists, industrial executives and others interested in the better training of juvenile and youthful workers. A large number of papers were read bearing upon mercantile, trade school, apprentice course, factory and special evening instruction facilities. Prominent among these were a paper by Mr. Tracy Lyon which described the apprentice course of the Westinghouse Electric & Manufacturing Company; a paper by Mr. F. W. Thomas upon the apprentice course of the Atchison, Topeka & Santa Fé Railroad; a description by Mr. George C. Cotton of the mechanics' educational course of the Solvay Process Company, and a discussion by Mr. G. M. Basford of the system for preparing recruits in the service of the American Locomotive Company.

All the speakers present voiced the need of first-class skilled mechanics rather than the dearth of mechanical draftsmen and technical graduates. The well-known Westinghouse courses aim to produce all-around mechanics, with encouragement of

latent efficiency in handling specialized tools. The Atchison paper stated that the company spends about $40,000 per year in training boys for future needs, but the result is that the recipients of the training accomplish enough work above the normal amount to pay for their instruction. The importance of paying a living wage to industrial apprentices was generally conceded. Part-time and evening schools also received much attention at the convention, and an able address was delivered by Dr. Georg Kerschensteiner, of Munich, Bavaria, on "Continuation Schools." The final session was devoted to the broader economic aspects of industrial education, the principal speakers being Prof. T. N. Carver, of Harvard University; Miss E. B. Butler, of the Bureau of Research, New York, and Mr. C. H. Winslow, of the American Federation of Labor. A feature of the convention was a banquet tendered the society by the Boston Chamber of Commerce, ex-Governor Guild, of Massachusetts, presiding. Among the speakers were Mr. F. A. Delano, president of the Wabash Railroad, and Mr. F. P. Fish, chairman of the Massachusetts Board of Education and former president of the American Telephone & Telegraph Company. An elaborate exhibit of industrial educational courses, problems and apparatus was held at the Boston Public Library during the convention.

Schoolroom Lighting.

A regular monthly meeting of the New England Section of the Illuminating Engineering Society was held at the Edison Building, Boston, on the evening of Nov. 14. Mr. C. O. Baker, chairman of the section, presided, and there was an enthusiastic attendance of central-station men and others interested in lighting work. Prior to the opening of the discussion of the evening Chairman Baker announced that plans are afoot to establish a question box, with the object of furnishing members with prompt and efficient answers to troublesome problems occurring in their practice. Details are to be announced later. He also stated that the section intends to have an afternoon session in February, with three papers, to be followed by a dinner and informal evening gathering.

SCHOOLROOM LIGHTING.

The evening was principally devoted to a discussion of schoolroom lighting, the opening remarks being made by Mr. B. B. Hatch, of the Boston School Commission. The speaker stated that he wished to emphasize what the society could do to promote and further public-school interests. He said that it is impossible for a man in municipal employ to give sufficient time to the scientific study of illuminating problems, and that the work of the society is capable of being very useful, particularly in putting the illumination of educational institutions on an engineering basis. The general tendency of illuminating engineers and the technical press is to treat the classroom as a problem involving nothing more than placing a few light sources in a room to give practically even illumination, with the object of satisfying the greatest number of persons. Nothing could be further from the truth than this conception of the elementary simplicity of the problem. The first step is to get an even distribution of light and a sufficient number of foot-candles of illumination, but that is not all.

One of the first difficulties of the Boston School Department was the question of color, its effect on the individual, and the relation of furnishings and trimmings on the light itself. Tinting is usually determined by the architectural authorities as follows: They prescribe that a room having a sunny exposure shall be tinted a grayish green in its walls, and on the dark sides of the room the architect calls for light buff or yellow trimmings. Mr. Hatch favors the buff tints on account of their improved coefficients of reflection. Buff gives a coefficient of reflection of 52 or 53 per cent, compared with from 44 to 47 per cent in the case of grayish green. On the other hand, buff has a dead appearance in the night, even with the illumination provided by the tungsten lamp. It is most difficult to provide an illumination which shall be equally satisfactory for day and night school service.

Mr. Hatch then considered various points brought out in the Illuminating Engineering Society paper of Messrs. Knight and Marshall upon schoolroom illumination, read before the society during the past winter. The authors of this paper concluded from tests that a symmetrical six-outlet arrangement was the most satisfactory for the ordinary schoolroom. This conclusion was a surprise to the Boston authorities. The tests given in the paper were made in a room which had never been tinted, in which grayish-white plaster was used, and no consideration was given to the shadow effects of the pupils. The authors referred to a nine-lamp arrangement installed with the lamps 8 ft. 7.5 in. above the floor, and a six-lamp outfit placed 9 ft. 7.5 in. above the floor. In Boston the minimum height of lamps is 10 ft. Mr. Hatch said that in his opinion the authors had overlooked an important factor in taking no account of the shadow effect of the pupils. With 100-watt lamps and the bowl type of reflector the authors estimated that the mean illumination expressed in foot-candles was 3.65, and yet the results were scarcely satisfactory. In Boston the practice prescribes nine 60-watt lamps, or a total of 540 watts, compared with six 100-watt lamps, or 600 watts total, in the authors' paper for the same schoolroom conditions. Mr. Hatch said that it may be possible to get fairly good lighting where the number of rows of desks does not exceed five in width, provided two rows of lamps are used, but the problem is not altogether the particular number of lamps and their location. The height of the room, arrangement of furniture, color of side walls and ceiling, treatment of side walls with relation to the color of the room and the lighting, the actinic qualities of the light, and other factors all bear upon the selection and proper installation of the service.

Mr. Hatch contended that more children come to school with their eyes injured by improper home lighting conditions, particularly at the study table, than are hurt by improper lighting in the school itself. The school authorities naturally have no control over home lighting conditions, and the greater part of the eyesight injury occurs at the pupil's residence, in many cases. He touched upon the difficulties of providing proper illumination in the twilight period.

Referring to unilateral natural lighting specified by architects, Mr. Hatch said that in new buildings the authorities prescribe that the window space shall equal one-fifth the floor area. This gives one-half the illumination on the fifth row of desks that is delivered to the first row. It is very difficult to avoid conditions leading to eye strain in rooms from 30 ft. to 34 ft. wide, containing in some cases nine rows of desks, with one or two windows in the rear of the room. In many cases it is better to draw the shades of the windows than to attempt to blend the natural light and the artificial illumination.

For schoolroom work the tungsten lamp is the best, but even this does not meet the conditions in some instances. The extension of night-school work in large cities is placing more and more difficult problems upon the shoulders of the illuminating engineer, notably in connection with the lighting of sewing rooms, manual-training and drawing rooms. Where a drawing room is lighted by an indirect arc system the color of the ceiling plays a far more important part than with direct illumination. Mr. Hatch cited an instance where a painter overdid the coloring of a ceiling ordered to be light buff, making it a strong yellow in tone, with the result that the actual illumination was improved 100 per cent. He urged in closing that the society take up the question of schoolroom lighting further, in the interest of the general public welfare. Its recommendations carry weight with school authorities, and enable the illuminating force to secure better installations in many cases than would be possible under their own initiative.

Discussion.

Dr. Louis Bell said that he thoroughly agreed on the wisdom of placing the lamp high enough to be entirely out of the range of the pupil's vision. In a counting-room in a Boston bank he found that ten out of twelve clerks wore blinders continually, and the others frequently, on account of the exposure of the

incandescent lamps to their direct vision. In this bank the lamps are only 6 ft. above the floor. Dr. Bell said that all through the Boston suburbs it is possible to find the sins of illumination in profusion. It is of prime importance to educate the school teacher in the fundamentals of proper lighting. The subject probably receives no attention in any normal school. The society could do good work in this direction, for at present the average teacher has little if any idea of even the rudiments of illumination. Carelessness and ignorance in the use of existing installations need to be overcome. Mr. J. S. Codman concurred with Dr. Bell regarding the importance of bringing home to the teacher through the society the elements of lighting. Mr. Hatch added that various boards of education, business agents and building superintendents should not be allowed to interfere with the proper use of light by the teachers. Too great zeal for economy in expenditures often leads to poor illumination on account of the inability of the staff to use the equipment already installed. Mr. Hatch said that shadows can be eliminated by putting in lighting units in sufficient numbers at close enough intervals and at suitable heights to make it impossible for any one pupil to cast a shadow on the desk of another. Replying to a question, he stated that two installations of prismatic window glass have been put in in Boston, but that the full benefit is not obtained on account of the failure to keep the windows clean enough, and also in one instance on account of the tendency of the glass to become "stale."

Mr. Hatch said that unilateral lighting has been tried in Boston from rows of lamps placed along the side of the room, the second row being screened from the first, but that the results had not been satisfactory. The pupils were constantly induced to look upward and away from their desks. As in indirect lighting the best illumination appears psychologically to be overhead. Any plan which would step down the natural light by the window and step it up, so to speak, within the interior of the room would be a decided help.

Dr. C. H. Williams cited the tendency for schoolhouses of the older type to employ clusters of bare lamps, which produce trouble on account of glare, leading to a diminishing of the acuteness of vision and the ability to read without a sense of fatigue. Lamps must be screened. He declared that any form of indirect lighting is necessarily expensive, since 50 per cent is lost initially at the first surface and then only 45 per cent more gets to the eye from the paper. In other words, only about one-fourth the illumination in indirect service reaches the eye itself. Yellow light gives a sharper image on the retina than does light reflected from a green surface. With very small amounts of gray and black in the tinting of a room one finds the coefficient of reflection decidedly reduced. The use of blackboards covering a large proportion of the wall surface tends to cause a heavy absorption of light. For the benefit of securing distant vision it would be well to install additional blackboard lamps, screened from the students. Mr. Hatch pointed out that the angle of incidence is very important with respect to the question of legibility. Dr. Williams said that it is impossible to get a black surface sufficiently absorptive to avoid the evils of bad reflection. He has found that test types printed on yellow ledger paper give the best results in the testing of vision. Dr. Bell commended the yellowish paper used in classical readers of the old style. Mr. Hatch said that in Boston it has been found more restful to the eye to finish rooms in lighter woods in preference to dark upper walls and Flemish oak.

Final Hearings in Massachusetts Transmission Investigation.

The Massachusetts Gas and Electric Light Commission closed its hearings upon Resolve 55, Acts of 1910, upon Nov. 11, investigating the conditions and laws bearing upon the transmission of electricity in bulk in the State, which were noted in our issues for July 7 and 21. At the hearing held on Oct. 31 Mr. W. Rodman Peabody, counsel for the Amherst Power Company, cited cases in Maine and New Hampshire where the right of eminent domain had been granted by the Legislature to central-station companies, and said that all he desired was to sell energy to local distributing companies and that he believed in a minimum limit of 300 hp as laid down by the board in the Fitchburg and Worcester appeals.

Mr. M. B. Jones, counsel for the New England Telephone & Telegraph Company, submitted proposed amendments to Cnapter 122 of the Revised Laws of Massachusetts, bearing upon the joint use of poles and other structures in the public streets by different corporations when the ownership of those structures is in one of the corporations, the possible granting of the same location or identical locations to the same wire-using corporations and their joint use of those locations or other structures belonging to them jointly, and other minor matters.

Mr. E. W. Burdett, counsel for the Massachusetts Electric Companies and the Hyde Park Electric Light Company, referred to the pressure of public authorities to require the concentration of wires on a single line of poles. He felt entirely clear on the point that the public authorities cannot force the use of the property of one company by that and some other organization. It is also doubtful if companies can combine to use pole lines without the consent of the municipal authorities. The law should be amended so as to permit the joint use of poles and fixtures, ratifying all locations heretofore granted by municipal authorities under the statutes. Mr. Burdett filed an amendment to remove doubts as to the validity of such locations, and also introduced an amendment simplifying the granting of pole locations to street-railway companies.

At the final hearing on Nov. 11 Mr. Burdett, representing the Massachusetts Electric Lighting Association, stated that the executive committee believes that there is no present necessity of extending to electric transmission companies authority to exercise eminent domain provided the law with respect to the securing of locations in the public streets can be so changed as to affirm the so-called "missing-link" principle which for several years has worked out so well in street-railway practice. The Massachusetts Electric Lighting Association feels that the passage of a law giving the commission the power to overrule obstructive acts on the part of local authorities would avoid the very serious opposition of the public to extending the right of eminent domain to transmission companies. Mr. Burdett contended that the remote highways are safer than the open country for high-tension lines of moderate voltage, such as are coming into use for central-station transmission service. He did not desire to invoke any "missing-link" law except in cases where a real necessity exists for the supply of electrical service.

The final speaker was Mr. Alton D. Adams, counsel for the town of Leominster, who reiterated his argument that eminent-domain rights should not be granted unless the recipient is required to sell electricity to all comers. He criticised the amendments to the law suggested by Mr. Jones and emphasized the importance of having public hearings in connection with lines crossing public ways, on trees or in new locations. He also urged the marking of wires and poles in a more complete manner, touched upon the necessity of better records of location grants and urged the placing of definite responsibility in case of accidents from lines on the public ways. He opposed the passage of a "missing-link" law with transmission companies as the beneficiaries unless all parties are required to be served alike with electricity. The board took the case under advisement and will make a report of its conclusions to the next Legislature early in 1911.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has approved ordinances of the townships of Glassboro, Woolwich and Washington, Gloucester County, granting franchises to the Gloucester County Electric Company. The board has also approved the ordinance of the town of Morris-

town granting a franchise to the Morris County Traction Company.

The board has approved the agreement of consolidation and merger of the Pitman, Glassboro & Clayton Gas Company and the New Jersey Gas Company. The petition for the approval of this merger set forth that the plants and distribution systems of the companies lie in separate districts and that no competition exists or has existed between them; that all the gas used and sold by the New Jersey Gas Company is furnished by the Pitman, Glassboro & Clayton Gas Company, and that by the merger the companies will be able to effect substantial economies in the cost of operation and afford the public more satisfactory service.

The board has also approved the ordinance of the City of Burlington granting a franchise to the Burlington Electric Light & Power Company. This franchise is for a period of fifty years and as originally passed by the City Council of Burlington was vetoed by the Mayor and passed over his veto. At the hearing upon the question of the approval of the ordinance by the Board of Public Utility Commissioners several amendments to the ordinance were suggested by the board. These were agreed upon by representatives of the company and the city and were incorporated in a new ordinance, which passed the City Council and was approved by the Mayor.

Massachusetts Commission News.

As a result of the recommendations of the Massachusetts Highway Commission the New England Telephone & Telegraph Company has reduced the toll rates from 10 cents to 5 cents between the metropolitan exchanges in Boston and the suburban exchanges within an eight-mile radius of the city. The reduction forms a part of the general rate recommendations of the commission following the recently completed investigation of the problem by Prof. D. C. Jackson, its consulting engineer. Many thousand subscribers have applied for service under the new rates, which are assigned on a provisional contract of one month's duration. In the great majority of cases the tendency will be to reduce the cost of service to subscribers whose interests are largely confined to the business district of Boston and their own suburban zones. Two-party lines with divided ringing are being installed throughout the entire Boston and Suburban district. As a result of an open "experience meeting" held a few days ago at the Boston City Club, at which Professor Jackson explained in full the difficulties of the rate problem and submitted to questions from all sources, hostility to the new schedule of rates appears to be on the wane and the public is slowly coming to appreciate the desirability of a fair trial of the revised charges before passing judgment upon them. The commission has made every effort to hear the suggestions and criticisms of interested parties, holding the hearings open far beyond the time originally expected, and has further requested the telephone company to permit the retention of the old rates for another year when desired. The board has also made it plain that if the new rates are found to be inequitable on trial changes will be in order.

An interesting situation has arisen in connection with the offer of President C. S. Mellen, of the New York, New Haven & Hartford Railroad, to electrify and standardize the gage of the Boston, Revere Beach & Lynn Railroad Company in case the next Legislature permits the purchase of the latter by the former. There is now pending before the Massachusetts Railroad Commission a petition for a certificate of exigency desired by the Boston & Eastern Electric Railroad Company, which has for several years been trying to obtain the right to build a high-speed electric line between Post Office Square, Boston, and the cities of Lynn and Salem. At the last legislative session the company obtained authority to construct a tunnel under Boston Harbor. At the many hearings on this project testimony was introduced by both the Boston & Eastern and Boston, Revere Beach & Lynn companies to the effect that the latter could not at present afford to electrify its lines and build a tunnel into the City of Boston. The proposition of President Mellen has aroused great interest in the North Shore cities and towns and is likely to exert considerable influence upon the decision of the railroad commission in the Boston & Eastern case. It is proposed to bring the electrified Boston, Revere Beach & Lynn road into Boston by a tunnel between East Boston and the South Station, thus affording quick connections between the northern suburban area and points at the south and west of Boston. It is probable that the road will be extended to Salem and Beverly if the Legislature grants permission for its purchase by the New Haven interests, and with this extension the electrified lines would in large measure perform the service now proposed by the Boston & Eastern company. It is expected that the struggle between the Boston & Eastern and the existing transportation companies will be renewed in active form shortly after the next Legislature convenes in January, 1911.

The Athol Gas & Electric Company has appealed to the Massachusetts Gas & Electric Light Commission against the recent action of the Selectmen of Athol granting the L. S. Starrett Company the right to erect poles and wires in the streets of the town. The grantee is a large manufacturing company in the community and the local central-station organization declares itself aggrieved by the giving of the franchise. A hearing will be assigned by the board.

The Arlington Gas Light Company has applied to the commission for authority to increase its capital stock by the amount of $100,000. It is proposed to issue 1000 shares of stock at the price of $100 each, the proceeds to be applied to the payment of floating debt and the cost of constructing extensions and plant additions.

The Massachusetts Railroad Commission gave a hearing on Nov. 16 upon the appeal of the Boston Elevated Railway Company against the action of the Cambridge Water Board by which the latter refused to agree to the relocation of an important water main in Massachusetts Avenue according to plans proposed by the railway company in connection with the building of the Cambridge subway. It developed at the hearing that the chief issue is the agreement of both parties upon a solution of the problem, and the case was held open to permit further technical conferences. The company maintained that the water board did not give it the legal determination of the problem to which the statutes entitle it and contended that it had no right to condemn private property for the relocation of water mains. Counsel for the company have also filed a brief declaring against the passage of a law requiring street railways to interchange cars, on the ground that such a statute is not needed; that the Boston Elevated is already receiving the cars of foreign companies and that a general interchange is undesirable on the ground of safe operating.

New York Commission News.

The Public Service Commission, Second District, has closed upon its records the complaint of Ernest A. Kelly, of Port Ewen, Ulster County, against the New York Telephone Company as to alleged refusals to furnish telephone service under certain circumstances, complainant having advised the commission that since the filing of the complaint a satisfactory adjustment has been made with the company.

The commission has consented to the transfer by William Stock of certain property, rights and franchises to the Hannibal Electric Company; also of a franchise held by him in the towns of Granby and Hannibal and the village of Hannibal, Oswego County. The Hannibal Electric Company is permitted to sell, transfer and assign its franchises in the towns of Granby and Hannibal and the village of Hannibal to the Oswego River Power Transmission Company.

The Livingston-Niagara Power Company has been authorized to exercise franchises in the towns of Avon, Caledonia, Geneseo, Lima and York, and in the village of Caledonia, in

the County of Livingston, and in the towns of Mendon, Rush and Wheatland, in the County of Monroe. The company proposes to distribute Niagara electric energy through the territory in which it has obtained franchises.

The Islip Electric Light Company has been authorized to issue $30,000 capital stock and bonds to the amount of $20,000. The proceeds are to be used for the improvement and extension of the plant of the company at Islip, L. I.

The Public Service Commission, Second District, has begun proceedings against a number of gas companies who are selling gas of inferior quality. State standards of illuminating power and purity are prescribed and the companies are supposed to manufacture and distribute their product in accordance with these standards. To see that they comply with these requirements the commission has a force of inspectors who are constantly employed in testing gas. These tests are made without warning to the companies. If the inspector reports a deficiency the company is notified and is directed to take steps to improve the quality.

The records in the office of the commission show that the gas of a number of the companies is consistently of an inferior quality in respect to either candle-power or purity, and the commission has summoned these companies to appear before it in Albany, on Dec. 6, to show cause why an order should not be entered requiring them to manufacture and distribute gas in accordance with the prescribed standards, and why suit should not be begun to recover penalties for past deficiencies. The companies affected are the Rome Gas, Electric Light & Power Company, Sea Cliff & Glen Cove Gas Company, Central New York Power Company, of Canastota; Halfmoon Light, Heat & Power Company, of Mechanicsville; People's Gas & Electric Company, of Oswego, deficient in candle-power requirements; the Malone Light & Power Company, Newburgh Light, Heat & Power Company, deficient in candle-power and sulphuretted hydrogen requirements; the Homer & Cortland Gas Light Company, United Gas, Electric Light & Fuel Company, of Sandy Hill and Fort Edward, and Watertown Light & Power Company, deficient in candle-power and sulphur requirements; the Glens Falls Gas & Electric Company, deficient in sulphur requirements; the Waterville Gas & Electric Company, deficient in sulphuretted hydrogen requirements.

Maryland Commission News.

The commission is at present completing its arrangements for the establishment of a bureau for the handling of all of the gas and electric inspection, both as to meters and quality of service. The law requires the commission to make such inspections at the company's station, the company to furnish the instruments. Chairman Ambler, of the commission, has stated that the commission is not prepared to say definitely when the bureau will be in working order, and that the entire work is in charge of Mr. Phelps, the engineer to the commission.

The commission has given out a statement showing the number of dead telephone wires it has caused to be removed since its attention was called to the dangerous condition of some of the lines of the Maryland Telephone Company. From time to time various orders were issued to the several companies operating in Baltimore, and up to date 30,640 lb. of various kinds of wire, approximating 215 miles in length, have been removed by the Maryland Telephone Company. The Western Union Telegraph Company also complied with an order from the commission and removed wires, poles and cross-arms in the southeastern section of the city. The commission further notified the Maryland Telephone Company to remove within ten days a number of dead wires in the district covered by the company's Catonsville exchange. These wires were reported by the engineers of the commission as being a menace to public safety.

During the present week the commission will complete the telephone investigation, at which the complainants will be heard in person and the whole situation thoroughly discussed. During the past few days the local telephone company has also filed with the commission a copy of its annual report, which has been referred to the commission's engineer and accountant for the purpose of investigation and report. A number of important questions concerning the law creating the commission are likely to arise during the hearing, among others whether the law authorizing the $78 grounded service, which is the only unlimited service furnished by the telephone company, has been repealed by the Public Service Commission law.

Answering complaints which flowed into the offices of the commission immediately upon the announcement that the United Railways & Electric Company had discontinued a commuters' special rate on suburban lines, the United Company issued a statement defining its position. In this statement the company concurs with the view expressed by the commission that the special rate was prohibited by the Public Utilities law, but makes the point that the rate was put into effect long before that law was passed, that it was only adopted tentatively and that the result never has been a success financially. The commission gave an opinion that it was not within the powers of the commission to force the railway company to issue commuters' books. "While there is nothing in the law," said Chairman Ambler, "to prevent public-service corporations from issuing commutation tickets and running excursions at reduced rates, yet the commission seems to be restrained from requiring corporations to provide special rates under any conditions." Mr. Allan C. Girdwood, who introduced the Public Utilities bill in the Maryland Legislature, has expressed the opinion that the members of the commission are mistaken in their interpretation of the law. The withdrawal of the commutation tickets was the result of a resolution by the Public Service Commission after hearings for the reduction of fares on the company's line between Baltimore and Ellicott City, in which the commission criticised the United Railways for unjust discrimination and had its counsel advise the company that all patrons of the company should be subject to the same fare as the residents through which their lines passed. The company has therefore adopted the only plan possible to comply with the wishes of the commission.

Société Internationale des Électriciens.

MANY of the older members of the electrical profession will recall with a thrill the International Electrical Exposition which was held in Paris in 1881. It was there that the power of the new agent which was partly to revolutionize the world industrially was first adequately revealed, and the enthusiasm at that time can be compared only to that which is aroused to-day by the progress in aeronautics.

At the close of the exposition a group of men conceived the idea of continuing the movement thus initiated by the creation of an international society which would bring together all those who were interested in or concerned with electricity. A provisional committee with M. Maurice Loewy, then director of the Observatory of Paris, as president, was formed on June 21, 1883, which transformed itself on July 7 of the same year into a committee of organization under the chairmanship of M. George Berger, who had been general commissioner of the exposition of 1881. On Aug. 25 a printed draft of the constitution and bylaws was sent to all countries, and more than 1000 favorable replies were received within a very short period. Three hundred and fifty members were present at the first general meeting, held Nov. 15, 1883, and upon these were conferred the title of founder member. There are to-day still living about 220 of these original members. Among the founder members the following names may be mentioned: d'Arsonval, Becquerel (father and son), Shelford Bidwell, Bosscha, Branly, Breguet, Carpentier, Crompton, P. Curie, J. B. Dumas, Fitzgerald, de Freycinet, Gaulard, J. Gavey, R. Kaye Gray, Von Helmholtz, Hittorf, Hospitalier, Jablochkoff, Jamin, Fleeming Jenkin, Kirchkoff, Maurice Leblanc, Lippmann, Marey, Melsens, G. Plante, Preece, Sir William Siemens, Werner Siemens,

Stoleton, Violle, Weber and many others whose names have been celebrated in the field of electricity.

The new society set itself at work immediately, and the contributions presented at its first sessions were full of interest. One of the first papers was that of Gaulard on the transformer and Hospitalier at an early session began his advocacy of a logical and correct nomenclature for designating the quantities and units employed in the study and practice of electricity.

In 1885 the vigor of the young society manifested itself by the organization of an exposition which, without pretending to be on a plane with that of 1881, was a considerable success. This exposition was entirely free. It opened on March 21, in the building of the Observatory of Paris, which had been courteously put at the disposition of the society by its director. From 6000 to 7000 persons a day crowded its halls, which were entirely too small to accommodate properly the visitors. The curiosity excited by the electrical displays, still so new, was great, and instruction sought at the exposition was imparted through inspection of many interesting novelties exhibited there by the most eminent investigators. In 1896 the society organized on a more modest scale an exposition of the domestic applications of electricity.

The greatest achievement of the Société Internationale des Électriciens was, however, the creation of the Laboratoire Central and the École Supérieure d'Électricité. The exposition of 1881 terminated with a surplus of about 330,000 francs. The association which had guaranteed financial aid to the exposition, if necessary, to assure its certain success, resolved to leave this sum to the State, to be devoted to a useful purpose in the development of electricity. On Feb. 24, 1882, the President of the Republic, at the suggestion of the Minister of Posts and Telegraphs, signed a decree instituting at Paris a Central Laboratory of Electricity.

For various reasons, which are difficult to appreciate at the end of thirty years, several years passed without anything being done by the State to carry out this project, but the men to whom the success of the exposition of 1881 was due had continued their work by founding the Société Internationale des Électriciens, and it is to them that thanks are due for coming to the rescue of the plan to establish the laboratory. On May 30, 1886, the society appointed a committee to consider and report practical means for carrying out the project. After long and complicated negotiations with the State, extending over several years, and much study and discussion, the Société Internationale des Électriciens took upon itself the work of establishing the Laboratoire Central d'Électricité. The laboratory began operations in 1888, but it was not until 1892 that a regular agreement was made between the State and the society. According to this agreement, the State retained the entire control of the laboratory from the financial point of view and nominated the director, leaving the technical administration entirely to the Société Internationale des Électriciens. This organization remains unchanged. The laboratory has all the characteristics of an official establishment, but it is administered by a private organization devoted to public utility.

This organization has yielded excellent results. Instead of being administered by public officials, as is too often the case with government establishments, the laboratory is under the direction of men connected with the industry which it serves, and its resources are utilized with the greatest possible efficiency.

The laboratory is equipped to make all tests demanded by the industry. Since its foundation up to Dec. 31, 1909, 13,379 tests have been made, of which an itemized list is given below:

Ammeters	1,422	Primary batteries	470
Voltmeters	1,330	Resistances	942
Watt-hour meters	3,910	Wattmeters	119
Incandescent lamps	2,307	Sheet-iron	279
Arc lamps	295	High-tension measurements	169
Miscellaneous lamps	110	Precision measurements	17
Storage batteries	374	Tests of installations	38
Insulating materials	476	Miscellaneous	484
Machines	558		
Lightning arresters	69	Total	13,379

Furthermore, numerous researches are carried on, the results of which are published under the title "Travaux du Laboratoire Central d'Électricité," the first volume of which has been issued by Gauthier-Villars. Among these investigations may be cited, as having a particular bearing on practical engineering, researches on the electric arc, photometry of lamps, oscillatory phenomena in conductor networks, etc. From the scientific standpoint may be cited researches on photometric standards and, above all, on electrical standards.

From the origin of the laboratory a number of students have been allowed to take part in its routine work, but no regularly organized instruction had been given to them. In 1894 the Société Internationale des Électriciens deemed it advisable to develop this branch by founding a technical school, intended to complete from a practical viewpoint the electrical education of young men possessing a well-rounded general education. This was the origin of l'École Supérieure d'Électricité, which school has to-day an organization independent of the laboratory, except that it is under the same director. The present director is Prof. Paul Janet, who is also professor at the Sorbonne. The school is administered by two councils, one of which occupies itself with administration and the other with instruction, both councils being composed for the greater part of members of the Société Internationale des Électriciens. Most of these are foundation members, that is, individuals, societies or bodies which contribute to the support of the school by an annual payment of 1000 francs, or by a single donation of 10,000 francs. In contradistinction to the laboratory, l'École Supérieure d'Électricité is entirely independent of the State, being exclusively under the supervision of the society. The school has been very successful and has developed rapidly. In 1894 it had twelve students, while to-day there are more than 100. The State regularly sends officers and engineers there, and a large number of students come from foreign countries. The foundation of the school and of the laboratory is the crowning achievement of the Société Internationale des Électriciens. The buildings of the laboratory and the

Fig. 1—Laboratoire Central d'Electricité (Rue de Stael)

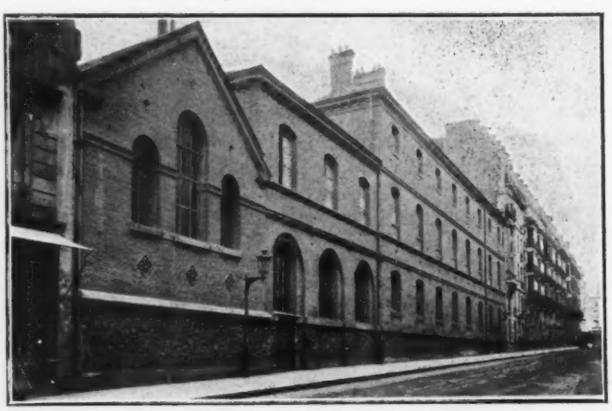


Fig. 2—L'Ecole Supérieure d'Electricité (Rue Ernest Renan)

École Supérieure were constructed at the cost of the society on a site conceded by the city of Paris for a term of sixty years.

The society has constantly maintained the liveliest interest in its monthly meetings. A great number of important communications have been submitted to it; and, without attempting to cite all, attention may be called to a few of the more important, such as the papers of d'Arsonval on the physiological action of alternating currents; by Blondel on the parallel running of alternators and on photometric units; by Hospitalier on the ondograph; by Boucherot on self-exciting alternators, polyphase motors with high starting torque, parallel operation of alternators and oscillating devices for alternating current; by Carpentier on measuring apparatus; by Cuenod and Thury on constant-current transmission; by Maurice Leblanc on the transmission of energy by alternating currents; by Mascart on alternating-current motors; by Potier on asynchronous motors, etc. On several occasions the society has undertaken extensive investigations on subjects of technical importance, including an exhaustive report, made in 1901, on the parallel operation of alternators and on the rôle played by governors therein; specifications and acceptance tests for cables; magnetic measurements, etc. Its services were also availed

President A. Bochet.

of by the Ministre de la Marine in the preparation of specifications for electrical materials used in the navy.

The society has played an active part in different electrical congresses which have been held since 1889. It took the initiative in the formation of the French Electrotechnical Committee, a branch of the International Electrotechnical Commission. It sent a delegate to the International Commission on Photometry. It provided for the expenses of a delegate from the Laboratoire Central d'Électricité, to participate in the international experiments on the silver voltameter and the cadmium standard cell which were recently carried out at the Bureau of Standards in Washington.

The Société Internationale des Électriciens is administered by a president, who is elected each year, six vice-presidents, and a council of forty-eight members, sixteen being elected each year. The president is selected a year in advance, and during this time takes part in the work of the council. He is chosen alternately from men of science and from men engaged in commerce.

The ex-presidents (fifteen in number) are ex officio members of the council. This body is divided into six sections, which meet once a month, their work being recorded in the monthly *Bulletin* of the society. The subjects of which the six sections have respective cognizance are as follows: (1) Production and mechanical utilization of electricity. (2) Electric lighting. (3) Eletrochemistry, electrometallurgy, primary and secondary batteries. (4) Conduit systems, general distribution and traction. (5) Telegraph and telephone. (6) Physical research, electrophysiology and measuring instruments.

The bureau of the society, consisting of the president, president-elect, vice-presidents and the general secretary, meets monthly for the consideration of the affairs of the body. It formulates the order of business to be brought before the monthly meetings and supervises the editing of the *Bulletin*. Annually it prepares a list of candidates for offices to become vacant at the end of the society year. Ordinarily the past-presidents propose the candidates for the offices of president and vice-president. The list thus prepared is submitted to the council, and, when approved, is printed and sent to all members of the society, whose votes are considered at the general meeting held in April, the members not residing in Paris voting by correspondence. The list thus prepared and submitted has always up to the present been accepted without modification.

The total budget of the society during the year 1909 amounted to $58,056, of which $11,672 was for the expenses of the society itself, $16,973 for the laboratory, and $29,470 for the school.

The president of the society is M. A. Bochet, Engineer of Arts and Manufactures, chief engineer of Sautter, Harlé & Company, and director of the ship and engine works of Augustin Normand. Mr. Bochet was born in Paris, 1863, graduated from l'École Centrale des Arts et Manufactures in 1886, and joined immediately the staff of the Sautter-Lemonnier Company, now Sautter, Harlé & Company, of which he soon became chief engineer. In this capacity he is chiefly occupied with the installation of electric lighting plants and the application of electricity in the army and navy. It may be noted that he was the first to introduce internal combustion engines into the navy by applying them on board submarines. Mr. Bochet is a Chevalier of the Légion d'Honneur.

AMERICAN ELECTRICAL ENGINEERS.—XX.

Carl J. Fechheimer.

Carl Joseph Fechheimer was born in Cincinnati, Ohio, Feb. 11, 1882, and after completeing the usual course in the primary schools entered at the age of fourteen years the Technical School of Cincinnati, a manual-training high school. After graduation in 1899 he was employed for eight months in the shops of the Triumph Electric Company and for two and one-half years in the testing department of the Bullock Electric Manufacturing Company. In September, 1902, Mr. Fechheimer entered Purdue University with sufficient credits to enable the electrical engineering course to be completed in three years, but there being a possibility that he might not be able to remain at Lafayette for more than two years he determined to complete the course in that time if possible. Through the cooperation of one of the seniors a schedule of studies to this end was determined, but this rendered it necessary to take examinations in a number of subjects without classroom preparation. The course was completed in two years with a good record, though the number of hours spent in university work was about 50 per cent greater than required in the regular course. The graduating thesis was based on an experimental and theoretical investigation of armature reaction in synchronous converters at various loads and power-factors, an abstract of which appeared in these columns in the issue of Oct. 7, 1905. The degree of B. S. in E. E. was obtained in 1904.

In the early part of 1904 Mr. Fechheimer found he would be able to devote another year to study and accordingly entered the post-graduate department of Cornell University, where, during that year, he studied under Prof. H. J. Ryan, Dr. A. S. McAllister and Dr. F. Bedell. For a thesis a study was made of alternating-current commutator motors, including an experimental and theoretical investigation of the compensated repul-

sion motor with the secondary of a transformer connected in series and with the brushes normally short-circuited, the primary being connected across the line.

After obtaining his degree from Cornell in 1905, Mr. Fechheimer again entered the employ of the Bullock Electric Manufacturing Company, which in the meantime had become a part of the Allis-Chalmers Company. For three and a half years he was engaged in the engineering department on the design of alternators, turbo-generators and induction motors as an assistant to Mr. A. B. Field, and under the guidance of Mr. B. A. Behrend. For somewhat more than a year following this period he was responsible for the electrical design of most of the alternators and turbo-generators built by the Allis-Chalmers Company. In January, 1910, Mr. Fechheimer left the employ of the Allis-Chalmers Company to take charge of the design of the alternating-current apparatus, including alternators, turbo-alterna-

Carl J. Fechheimer

tors and induction motors, built by the Crocker-Wheeler Company, which position he now occupies.

Mr. Fechheimer is the author of two papers read before the American Institute of Electrical Engineers in 1908 and 1909, having for subjects respectively "The Relative Proportion of Copper and Iron in Alternators" and "Comparative Costs of 25-Cycle and 60-Cycle Alternators." For a number of years he has studied the relation of current, voltage and power required to develop a definite torque at starting in polyphase synchronous motors, and a paper on this subject is now in preparation.

Mr. Fechheimer is an associate member of the American Institute of Electrical Engineers and a contributor to its *Transactions* and to the columns of the technical press.

International Comity in "Wireless."

One of the important wireless stations of the world is at Scheveningen, near The Hague, Holland. It is said that it was by means of this station, and not through the Eiffel Tower station in Paris, that the French people remained in touch with their President in 1908, when he visited England. President Fallières was on board a battleship at that time, and it was desirable that he keep in constant touch with his own capital. It was in vain, however, according to the present story, that communication by way of the Eiffel Tower was attempted. An attempt was then made to signal the Scheveningen station and this proved successful. After that the President's battleship communicated with France through the Dutch station. An important part of the duties of the powerful station at Scheveningen is to be on the alert for signals of distress from vessels in the North Sea. The latter has been divided into an eastern and a western part, the former being apportioned to the Dutch station and the latter to England. This imaginary boundary line is not very closely observed, however, in case a ship signals that it is in distress.

CURRENT NEWS AND NOTES.

Chicago I. E. S. Section.—The next meeting of the Chicago Section of the Illuminating Engineering Society will be held on Dec. 8, at which two papers will be presented by Professor Brown and Professor Hay.

Meter Tests.—Of 6580 electric meters tested during September, 1910, by the New York Public Service Commission, Second District, 356, or 5.40 per cent, were fast; 4985, or 75.76 per cent, were accurate, and 1239, or 18.84 per cent, were slow.

Convention of Alabama Light and Traction Association.—The annual convention of the Alabama Light & Traction Association has been postponed from Nov. 21-23 to Nov. 28-30. The meeting will be held at Aniston, Ala. Mr. George S. Emery, of the Alabama Light and Traction Association, is secretary.

Johns Hopkins Illuminating Engineering Lectures.—At a luncheon on Nov. 17 members of the Chicago Section of the Illuminating Engineering Society were entertained and instructed by five-minute reviews of the lectures delivered in the recent course in illuminating engineering at Johns Hopkins University. These lectures are now being prepared for publication in two octavo volumes of about 700 pages each.

Electric Vehicle Association of America.—A meeting of the Electric Vehicle Association of America will be held in the Engineering Societies Building, New York, on Tuesday, Nov. 29, at which Mr. C. L. Morgan, manager of the maintenance department of the General Vehicle Company, will present a paper entitled "The Proper Garaging of Electric Vehicles." This will be the first regular monthly meeting of the new association.

Sanitary District Asks to Be Investigated.—Upon the recommendation of President McCormick the trustees of the Sanitary District of Chicago have asked the new Bureau of Public Efficiency to make a thorough investigation of the affairs of the district at its earliest convenience. Mr. McCormick thinks it desirable to get an unprejudiced judgment upon the work of the various departments in charge of the trustees, particularly the electrical department.

Chicago Electric Club.—At the weekly luncheon on Nov. 16 of the Chicago Electric Club Mr. Fletcher Dobyns, formerly assistant United States district attorney, was the principal speaker, his subject being "Lesson from the Recent Election." Mr. Dobyns contended that if we are to have truly representative government in this country we must have not only the Australian ballot and the direct primary, but a corrupt practices act preventing the corrupt use of money in elections, state-wide civil service on the merit basis, and the initiative and referendum, so that the people may have power to control their representatives when the latter are faithless to their trust. These reforms will enable voters to vote for principles as represented by candidates unhampered by bosses, machines and interests. Part in the discussion which followed was taken by President F. P. Vose and Messrs. Thomas G. Grier, Donald M. Carter and Max W. Zabel.

Wireless Time Announcement from Eiffel Tower.—Under the direction of the Academy of Science, Paris, standard time will be announced by wireless telegraphy daily at 11 o'clock from the Eiffel Tower for the benefit of ships at sea within the range of communication.

Telephone Census.—The Bureau of the Census has just issued its report of the 1907 telephone census. The report presents statistics concerning the physical equipment, service and financial operation of the commercial and mutual telephone systems of the country and the independent rural telephone line for the year ended Dec. 31, 1907.

Chess by Wireless on Ships.—According to reports from Victoria, B. C., Captain Phillips and four passengers on the steamship *Zelandia* from Australia played a chess match by wireless telegraphy with Mr. Frick and four passengers from the *Makura*. The game began when the steamers were in sight of each other and the last move took place when they were 400 miles apart.

Massachusetts Technology Registration.—The total registration during the present year at the Massachusetts Institute of Technology is 1506. Students who come from other colleges number 405, representing 93 colleges, of whom 215 are graduates. There are 93 foreign students, representing 34 countries. Of these 27 are from China, including 13 students from the Imperial Polytechnic College at Shanghai.

Local Travel in New York City.—The number of passengers carried annually by the local railways in New York City has increased by 458,000,000, equivalent to 90 per cent, since 1899, when the contracts for the present subways were let. In 1899 the surface cars carried 360,000,000 passengers and the elevated cars 174,000,000. In the year ended June, 1910, the surface cars carried 430,000,000 passengers, the elevated cars 293,000,000 and the subway cars 269,000,000.

Toronto N. E. L. A. Section.—The Toronto Section of the National Electric Light Association has now over 100 members, and has been very successful in having good programs for its monthly meetings. Mr. J. H. Hughes, chief inspector of the Toronto Board of Education, addressed the October meeting on "Technical Education," and on Nov. 28 Mr. R. M. Searle, vice-president of the Rochester Light & Railway Company, will be the speaker. Mr. T. C. Martin, executive secretary of the N. E. L. A., will address the regular meeting to be held Jan. 26.

Electric Steel Furnaces.—In a paper read before the Engineers' Society of Western Pennsylvania on Nov. 16 Mr. P. McNiven Bennie, of Niagara Falls, N. Y., reviewed the history of the development of electric furnaces. He stated that electric furnaces in the United States will produce a total of 125,000 tons of steel during 1910, so that the process can no longer be considered experimental. He claimed that although the electric furnace will not replace the modern open-hearth steel furnace or the Bessemer converter, yet it will become a serious competitor of the present crucible process for making high-grade steel and will create a new metallurgy which promises to produce vast changes and improvements in steel making.

Electric Lighting and Railway Opportunity.—Among the foreign trade opportunities noted by the United States Bureau of Manufactures, Washington, is one reported by a consul in Latin America, who states that an English company owning a railway which is being extended in his district is about to obtain a concession from the local government for the establishment of electric light, power and railway systems in and about the city in which he is located. According to the provisions of the proposed concession, the works are to be established within five years from the completion of the present undertaking, which it is expected will be finished in 1911. This company also contemplates electrifying an entire line of railway which extends a distance of about 225 miles. The name of the official to whom correspondence, either in English or Spanish, should be sent is given in the report, the file number of which is 5799.

Tungsten Lamps for Train Lighting.—In an article in the November issue of the *Yale Scientific Monthly* Mr. D. F. Crawford, general superintendent of motive power of the Pennsylvania Railroad, states that there is no doubt that the tungsten lamp will replace the carbon lamp in train-lighting service. The success attending its use is attributable to the development of the so-called "hot circuit." By means of the hot-circuit method instead of turning the current completely off from the lamps when light is not required the lamps are merely disconnected from the main batteries and joined to one or two "hot-circuit" cells, sufficient current being produced in the lamps to show merely a faint red at night. This arrangement minimizes the breakages of the filaments.

Standard Tests of Insulating Materials.—The American Society for Testing Materials has appointed a committee on standard tests of insulating materials of which Mr. C. E. Skinner is chairman. The committee is securing from manufacturers, users and testing laboratories information in detail as to the methods pursued in making regulation electrical, physical and chemical tests. The more important of these tests will probably be standardized to the benefit of all concerned. The committee desires to obtain information and suggestions from all producers and users of insulating materials, and has asked for co-operation in this respect. The correspondence is being conducted by Mr. H. B. Brooks, Bureau of Standards, Washington, D. C.

Civil Service Aid for Bureau of Standards.—The United States Civil Service Commission will hold an examination on Jan. 4, 1911, for the position of aid at the Bureau of Standards, Washington. The examination will cover elementary algebra, geometry, trigonometry, general physics and elementary mechanical drawing. The applicants must be graduates of mechanical training, technical or scientific schools. The salaries for the position range from $600 to $720 per year. The work of the Bureau of Standards is scientific and technical in character, consisting principally of physics, chemistry, and mechanical and electrical engineering. It employs a large number of experts in each of these branches. Young men filling successfully the position of aid are eligible for promotion in the lines of work in which they have become efficient. The opportunity for study and advancement along the lines indicated is equal to that of the leading commercial or educational institutions.

New York Railroad Club Officers.—At a meeting of the New York Railroad Club held on Nov. 18 the following officers were elected: President, Mr. H. S. Haywood, superintendent of motive power of the Pennsylvania, Jersey City; vice-presidents, Messrs. Frank Hedley, vice-president and general manager Interborough Rapid Transit; W. J. Harahan, assistant to the president of the Erie; E. Chamberlain, chairman freight-car repair pool, New York Central lines; treasurer, Mr. R. M. Dixon, president Safety Car Heating & Lighting Company; executive member for three years, Mr. George Wilden, mechanical superintendent of the New Haven; member of finance committee for three years, Mr. Charles Shults. Secretary Vought's report showed that the club had 1500 members in good standing Nov. 1. A paper entitled *Employers' Liability and Railroad Relief Departments* was presented by Mr. Joseph N. Redfern, Chicago, superintendent of the relief department of the C., B. & Q.

Tungsten Production.—The total output of tungsten in Boulder County, Col., for the present year is estimated at $1,000,000.

Colorado Electric Club.—At the regular Thursday luncheon of the Colorado Electric Club on Nov. 17 Mr. John F. Greenwalt, of the Colorado Telephone Company, in the chair, articles of incorporation were presented and also a new constitution and by-laws. It was voted to incorporate the club for social and commercial advancement of electrical matters in Colorado.

Carnegie Gift to Technical School.—Mr. Andrew Carnegie has made a gift of $3,500,000 to the Carnegie Technical Schools in Pittsburgh. Of this amount $1,500,000 will be put at once into buildings and equipment, and $2,000,000 will be forthcoming as endowment. The gift is looked upon as a birthday offering from the donor, who will reach the age of seventy-five years on Nov. 25.

Ohio Society of Mechanical, Electrical and Steam Engineers.—At the annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers, held at Springfield on Nov. 18 and 19, the following officers were elected: President, Mr. Oscar F. Rabbe, Toledo; vice-president, Mr. H. L. Patterson, Youngstown; managers, Messrs. John J. Hoppes, of Springfield, and Daniel Delaney, of Cincinnati. It was decided to hold the next meeting in Youngstown on May 18 and 19. Cleveland was also an applicant for the meeting.

Kentucky Independent Telephone Association.—The first annual session of the western division of the Kentucky Independent Telephone Association was held at Paducah on Nov. 15. State President E. M. Coleman, of Louisville, addressed the meeting on organization in general, while Mr. J. W. Edwards, of Hopkinsville, talked on "Construction" and Mr. R. H. Polk, of Memphis, Tenn., on "Wood Preservation." Officers were elected as follows: President, Mr. W. R. Stanfield, Mayfield; vice-president, Mr. John M. Moore, La Center; secretary-treasurer, Mr. R. C. Royce, Mayfield. The next meeting-place will be selected later.

Suggested New York Subway Plans.—Mr. Frank J. Sprague has submitted to the Public Service Commission of the First District of New York two plans by which the city can build extensions to its subway routes and share properly in the profits derived from operation. According to one plan the extension to the present subway would be built with city funds, the operative equipment being provided from private sources, and the city would participate in all net profits after certain deductions. The alternative plan is for an independent subway line built by the city with the city sharing in both the management and the profits. Mr. Sprague expressed his willingness to bid for the operation of this proposed line, independently of the Interborough interests.

Smoker of Electrical League of Cleveland.—The Electrical League of Cleveland at a smoker held on Saturday evening, Nov. 19, under the auspices of the engineers of the National Electric Lamp Association, in the new engineering building of that organization, made a record in attendance, which numbered 375. The auditorium was handsomely decorated for the occasion and a collation was served in the luncheon-room maintained by the National Electric Lamp Association for its employees. The entertainment of the evening consisted of musical numbers, including mandolin solos and selections by a stringed orchestra, monologues, dialogues and an elaborately staged and costumed minstrel show. All the talent was supplied by the hosts, and the forty enthusiastic young collegiates who took the various parts earned a reputation for themselves in the theatrical line. Pipes, apples and cider were continually dispensed by the reception committee. The league contemplates holding three more smokers during the coming winter and it expects to accept the hospitality of other prominent electrical concerns.

Elevator Control.—A meeting of the Armour Institute branch of the American Institute of Electrical Engineers was held in Chicago on the evening of Nov. 17. Mr. G. E. Williams ('11) read a paper on "Otis Elevator Control," and there was some discussion. The author described the development of the control from the old rope-operated type to the presently purely electrical system. He also referred to the number of safety devices now available and pointed out that the working circuits are controlled by auxiliary circuits, so that the operator cannot damage the actual working parts by rough usage. Another point is the development of the dynamic brake combined with the ordinary friction brake. Attention was also directed to the load magnet, which operates to stop the car, when adjusted for that purpose, at a certain predetermined point, no matter whether the elevator is fully or partly loaded.

Proposed Telephone Regulations in Ohio.—As a result of the investigation of the Cleveland telephone service by a committee of the City Council last spring it is probable that a bill will be introduced in the Legislature the coming winter giving cities and towns power to regulate and control the service. Councilman Arnold, chairman of the committee mentioned, has prepared a resolution to be brought before the City Council which will ask the members of the Legislature from Cuyahoga County to support and work for the passage of a bill to this end that has been drafted. The resolution and copy of the bill will be sent to the councils of all other cities and towns of the State, asking that they present the matter to members of the Legislature from their districts and ask for its support. The report made by the Cleveland committee was to the effect that the service in Cleveland is inadequate. City Solicitor Baker informed the committee that the city has no power to regulate the matter, and members of the committee say that the telephone men asserted that the people are receiving just the kind of service they are paying for.

Minneapolis Electric Show.—The Minneapolis Electric Show will be held in the Minneapolis National Guard Armory during the ten days from Jan. 26 to Feb. 4, inclusive. This is the second annual exhibition held under the auspices of the Northwestern Electric Show Association, and elaborate decorative and entertainment features have been planned in addition to the exhibitors' displays. The 15,000 sq. ft. of the armory floor will be divided up into ninety booths and aisles. The ceiling will be hung with black velvet, and in the center will be a huge reproduction of an electric "shower" fixture studded with lamps and with 500-watt tungstens in the pendants. Spectacular electric displays will include a flasher rocket effect, ending in a burst of stars at the "shower" centerpiece, in which a shimmering fountain effect can be produced. The pergola arrangement of booths similar to that of last year, but with a different color scheme, will be used. The Northwestern Electric Show Association, which holds the Minneapolis Electric Show, is a co-operative organization representing the various electrical interests of the city—manufacturers, jobbers, contractors, sales representatives and central-station company. The officers are: President, Mr. Frederick G. Dustin, chief electrical inspector, Minneapolis; vice-president, Mr. George J. Cadwell, Cadwell & Brown; secretary, Mr. C. D. Wilkinson, Northwestern manager Western Electric Company, and treasurer, Mr. A. W. Leonard, general manager Minneapolis General Electric Company. In addition to the above, the following are directors: Mr. W. D. McDonald, Westinghouse Electric & Manufacturing Company; Mr. J. L. Barnard, Bryan-Marsh Company; Mr. W. F. Smith, General Electric Company. Mr. Robert W. Clark, assistant commercial agent of the Minneapolis General Electric Company, will act as general manager of the Electric Show.

THE HIGH FALLS DEVELOPMENT OF THE PESHTIGO RIVER IN NORTHERN WISCONSIN.

SINCE Oct. 29 the electric lighting and motor service and the street and interurban railway systems of Green Bay, Wis., and several adjoining towns have been supplied with electric energy over a 62-mile, 66,000-volt transmission line from the High Falls of the Peshtigo River, in Marinette County, in northern Wisconsin. The present development at High Falls comprises a concrete and earthen dam, almost a mile in length, creating an 85-ft. head for the 5000-kw generating plant at its base and impounding a storage area aggregating 1700 acres. This great undertaking has just been completed for operation; and to supplement its output the Northern Hydroelectric Power Company is now developing a 3000-kw site at Johnson's Falls at a point two miles below High Falls, where a head of 45 ft. will be available.

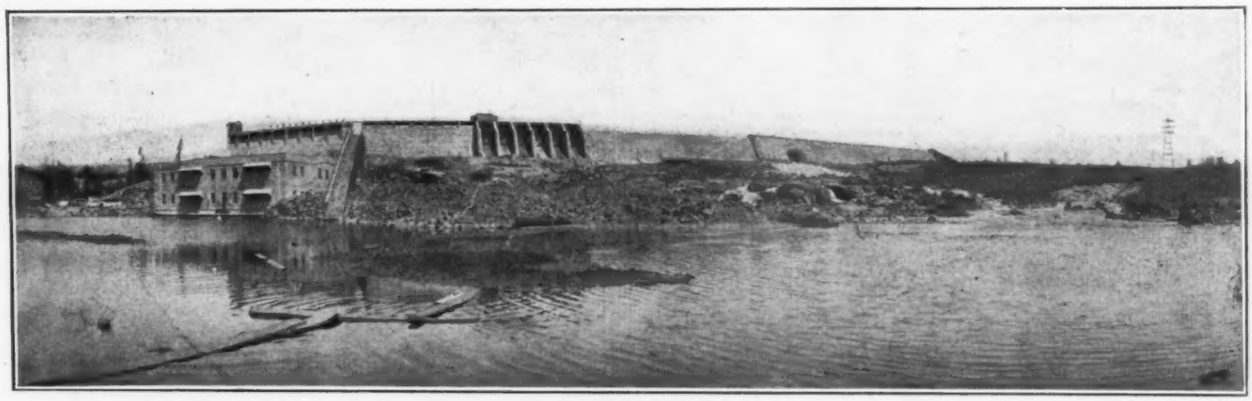


Fig. 1—Panorama of Concrete Section.

The Peshtigo River, on which these water-power sites are located, is notable among Wisconsin streams for its 1000 ft. or more of fall within its length of ninety miles, and for the comparatively uniform rate of its flow during the year, ranging from the normal value, 300 cu. ft. per second, to a maximum flood of 700 cu. ft. per second. The upper course of the Peshtigo, including the sites of High Falls and Johnson's Falls, is in the pre-Cambrian igneous rock, the backbone of the continent, which lies exposed here through the glacial drift and gravel. For ages this flint-hard granitic stone has remained the floor of these cataracts, and on this firm foundation are laid the hydraulic structures of the present development.

High Falls is in the midst of a wild and sparsely populated region, where deer, wolves and bear are still to be found. Lumbering is the principal industry of the section, although the great forests near by have suffered badly from fire. The site of the power plant is sixteen miles from the nearest settlement, Crevitz, or Ellis Junction, on the Marquette division of the Chicago, Milwaukee & St. Paul Railroad, and is reached from there only by driving across country. All of the machinery and power-plant supplies had to be transported over this distance by horses. Part of the apparatus was skidded over the snow during the winter season, but delays in getting other machinery in time required that trucking be resorted to over the hilly, winding and soft roads. It is reported that the total haulage cost exceeded $100,000 for the sixteen miles.

DAM AND HYDRAULIC WORKS.

The High Falls dam, constructed of concrete and earth embankment, closes between two rocky spines, the crests of which are almost a mile apart. Its average height of 45 ft. rising above the 40-ft. brink of the old cataract makes available a head of 85 ft. above the tail-race. The dam structure comprises several sections, differing in construction and direction to conform to the elevation of the rock beneath, and altogether aggregating 4500 ft. in length. The concrete section extends 900 ft., approximately in the center of the dam, and is flanked by earthen wingwalls locking into the hills at the sides. This concrete section contains the penstocks, discharge gates, log-chute and spillway, and in average section measures 45 ft. high, with a 64-ft. base carried on the native-rock ledge.

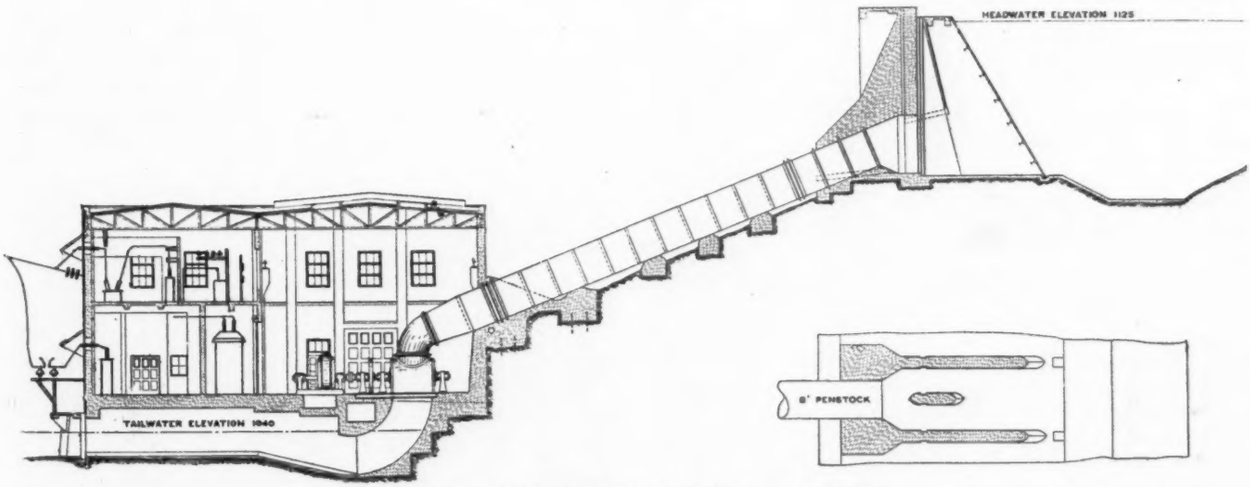


Fig. 2—Section of Power House, Penstock and Headworks.

The six 12-ft. x 12-ft. tainter gates provided are capable of discharging any normal excess of flow in the Peshtigo River. They are raised and lowered by a hand-operated hoist, mounted on a track so that it may be used to handle any gate. For dis-

charging excessive floods the 180-ft. spillway is provided, with its crest at the 85-ft. level. This spillway empties over a concrete apron built in a reverse curve to discharge its flow without vertical impact on the rock masses below. As the Peshtigo traverses a wild uncut forest region logging is one of the native industries of the surrounding country, and most of the wood obtained is floated down the nearby streams. Therefore, in accordance with the provisions of the Wisconsin state law, which recognizes the priority of the logger's right to the use of the streams, it was necessary to provide a log chute for "driving" timber through the High Falls dam. This chute is a wooden runway, 8 ft. wide and 260 ft. long, supported by timber trestle work. With the settling of the surrounding country and the decline of logging there this chute may later become unnecessary and can then be removed. Two 4-ft. x 4-ft. hand-screw-operated waste gates are also provided for bypassing the river water during the construction of the dam.

The east wingwall of the dam is 1250 ft. long and the west wingwall 2500 ft. Both are trapezoid in section, with 64-ft. base, 10-ft. top and one-to-three and one-to-two slopes on the upstream and downstream sides respectively. The wingwalls are of gravel and earth, with concrete core walls up to the 75-ft. level. On their upstream fans the wingwalls are faced with a riprapping of cracked granite, 6 in. thick. This is to be reinforced by the application of a lining of cement, while at the toe of the walls 6-in. groove-bolted timber piling will be driven 15 ft. into the soil, thus rendering the dam practically water-tight.

As now completed the High Falls dam at its 85-ft. level creates a series of three lakes extending back eight miles and having a total area of 1670 acres. This represents a storage of about 859,805,000 cu. ft., or the equivalent of 1,254,630 kw-hours, allowing for 80 per cent efficiency of the water turbines. At the 75-ft. level 840 acres are impounded, storing 174,000,000 cu. ft., or the equivalent of 348,000 kw-hours. The possession of this large storage capacity enables the total monthly flow of the stream to be conserved and utilized as the load demands it. Thus, while the minimum daily flow of the river is equivalent to only 1200 kw throughout twenty-four hours, it becomes possible with the aid of the poundage to develop 7000 kw under the average load factors equivalent to ten hours' daily use of this demand.

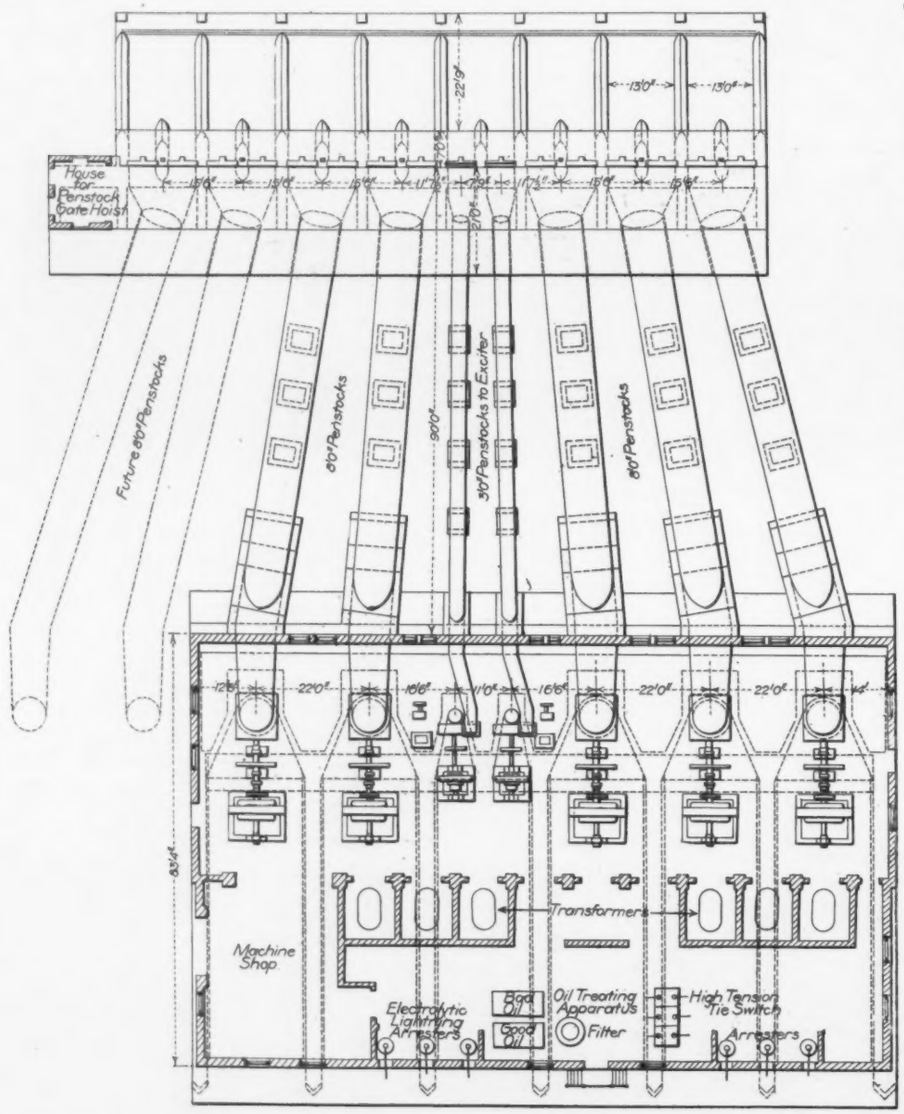


Fig. 3—Plan of Penstocks and Generating Station.

POWER HOUSE.

At the foot of the rock ledge on which sits the dam, and with its north wall 65 ft. from the penstock entries, is the power house, containing at the present time five 1000-kw turbine-generator sets. Water is conducted to the turbine wheels through huge 3/8-in. boiler-steel conduits, 8 ft. in diameter and 80 ft. in length. At their upper ends these penstock entries are protected by trash racks and by double vertical-lift gates, raised through racks by a movable gate hoist driven by a 7.5-hp motor. Each entry chamber is provided with a small hand-operated filler gate, for filling the penstock, and with a 10-in. air vent, through which is also brought out the chain controlling the valve to the drain which clears the penstock chamber of leakage water. The penstocks for the exciter turbines are 3 ft. in diameter.

The main generating units comprise five 1900-hp horizontal-shaft twin-runner plate-case waterwheels driving 1000-kw, 2300-volt, 25-cycle, three-phase alternators at 375 r.p.m. These units are individually controlled by oil governors equipped with several improved features for securing steadiness of action. On account of the long penstocks and the comparatively light rotating parts of the units it is necessary to change the admission-gate settings comparatively slowly, so that use is made of flywheels on the turbine shafts to overcome momentary changes of load. These flywheels are solid cast-steel disks with heavy hubs 7 ft. 10 in. in diameter, and have a moment of inertia of 80,000 ft.^{2}-lb. The turbines are designed to operate under a maximum effective head of 80 ft., but show sustained high efficiency under heads down to 65 ft. and at partial and full loads. The exciter sets comprise two 375-hp, horizontal-shaft, single-runner, spiral-case turbines, driving 200-kw, 120-volt, direct-current generators at 500 r.p.m. The output of either set is sufficient for the excitation of the entire plant. Discharge

water from the turbines is conducted through draft tubes, molded in the power-house concrete foundations, under the generator room and out into the tail-race below the dam. All of the generating machinery—water turbines, alternators, exciters and governors—was built by the Allis-Chalmers Company.

The power house is a two-story concrete structure, 136 ft. x

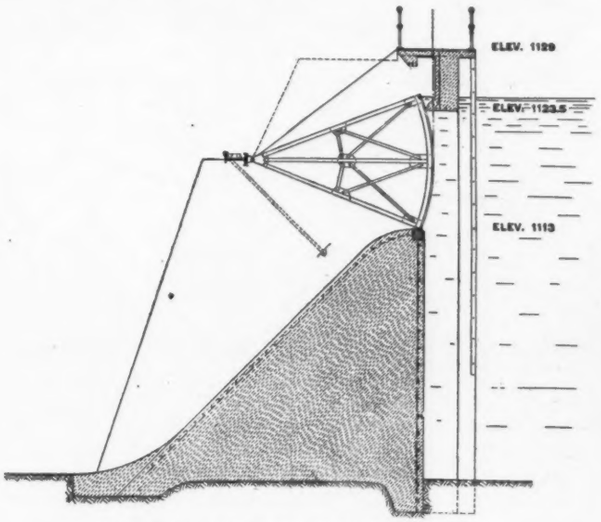


Fig. 4—Tainter Gates and Spillway Section.

83 ft. in plan, the second floor forming a gallery for the installation of switches, etc. The flat-tile roof is supported by steel truss construction 38 ft. above the generator room floor. Directly beneath it is the runway for a 30-ton hand-operated Northern crane. Besides the generating units, on the first floor are installed the step-up transformers, the 66,000-volt lightning arresters, the 66,000-volt tie switch, the transformer oil-treating outfit, and a machine shop. On the gallery level are the main switchboard, the 2300-volt generator and transformer switches, the main-line switches, the 66,000-volt series transformers and the operators' office.

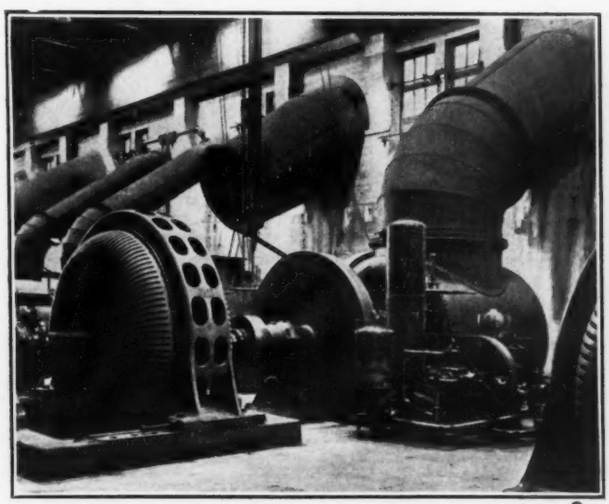


Fig. 5—One of the 1000-kw Water-Wheel-Driven Generating Sets.

From the generators the main 2300-volt leads are brought up in fiber conduit onto the gallery to Westinghouse solenoid-operated 400-amp generator oil switches, closing to the 2300-volt bus, which (except for disconnecting switches dividing it into three parts, each carrying two machines) runs through to all the other generator switches. One of the generators is arranged with duplicate oil switches for throwing it onto either of two of the three bus sections. As the transformer switches close onto two of these sections the arrangement makes it possible to operate any number of generators, up to the transformers' rating, on either bank of transformers. The 2300-volt buses are made of ½-in. x 3-in. copper section, protected by suspended barriers of ⅜-in. asbestos board. The series transformers for the 2300-volt meters are inclosed in 2-ft. x 2-ft. concrete compartments, with hook-suspended asbestos-board doors.

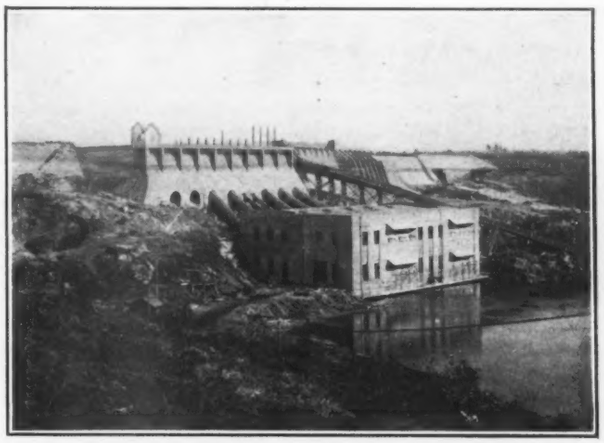


Fig. 6—Penstock Section and Power House.

The two main banks of three 1110-kw General Electric oil insulated, water-cooled transformers, stepping up from 2300 volts delta-connected to 66,000 volts with secondaries in star, and neutral grounded, are inclosed in separate concrete compartments on the first floor. Each recess is closed by a steel roller door. The valve for the cooling water and the discharge from the coils are brought outside the compartment at each side of the entry door, thereby avoiding the necessity for entering the transformer chambers. Combined with the transformers is a Westinghouse oil-treating and filtering system, capable of purifying and drying 2.5 gal. each minute. This outfit comprises a motor-driven centrifugal pump, a sand

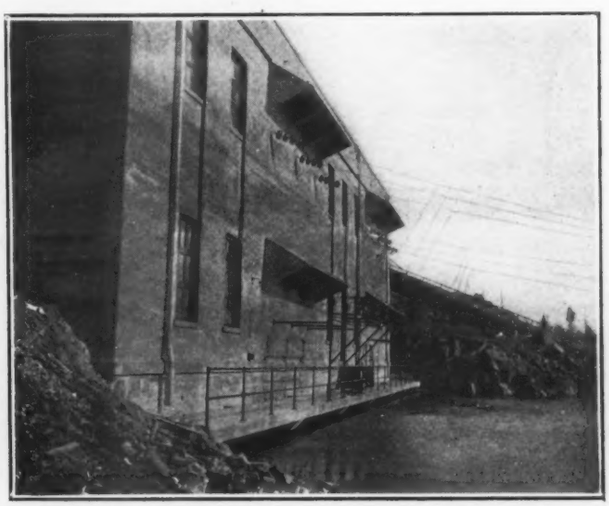


Fig. 7—High-Tension Line and Lightning Arrester Entries.

filter and a lime drier, through which the oil is forced, and a pair of oil-receiving tanks, one for "good" oil and one for "bad" oil, each holding the contents of one transformer tank. With the arrangement of piping provided connecting the transformer tanks with this oil-treating outfit the contents of any transformer can be delivered to either receiving tank, treated, stored, or returned to the same or any other transformer in the plant.

SWEDISH-IRON HIGH-TENSION BUSES.

From the high-tension terminals of the transformers the 66,000-volt buses, mounted on petticoat-type insulators and protected by suspended asbestos-board barriers, are carried up through the ceiling to the line switches on the second-floor gallery, taps being taken off at the ceiling for the 66,000-volt tie buses. A novel feature of all the high-tension buses in this station is the use of Swedish-iron conductor, 0.375 in. in diameter, to increase the inductance of the station buses as a preventive of the entrance of lightning. Where the lines enter the station from the outside the copper conductors are led directly to the lightning arresters, while the main lines to the transformers are of iron tapped on the outside of the station wall and connecting to the iron buses within. Before entering the Pacific Electric solenoid-operated, 66,000-volt oil switches on the gallery floor the outgoing high-tension lines are led through series transformers installed in separate concrete compartments with asbestos doors. The use of series transformers inserted in lines of potentials as high as 66,000 volts is unusual, and to guard against damage from surges the terminals of these transformers are bridged by aluminum cells and air-gaps, which provide a shunt path in case of rise in voltage across the terminals.

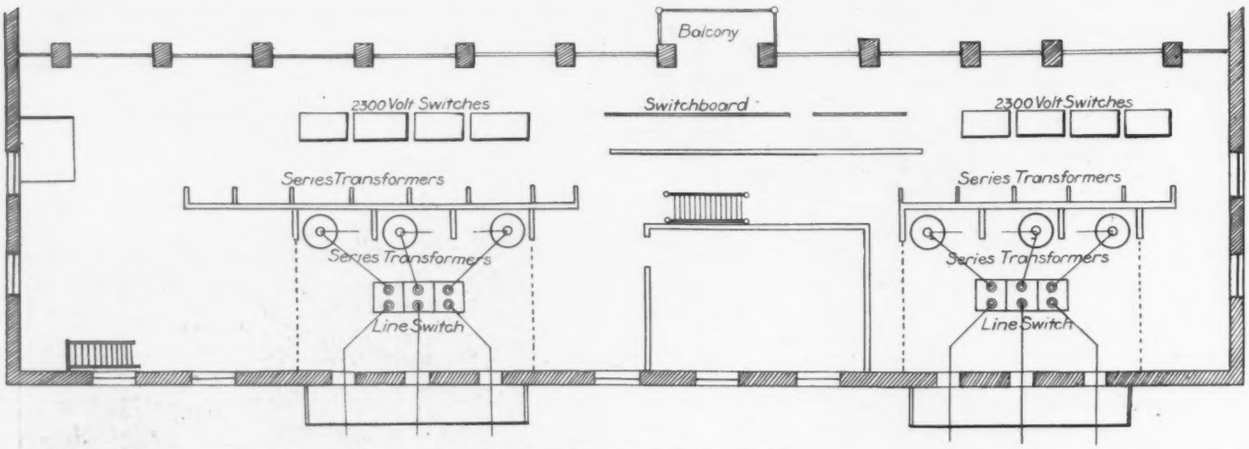


Fig. 8—Plan of Second Floor or Gallery.

The 80,000-volt, 150-amp-type Pacific Electric oil switches used for the two line switches and the high-tension tie switch are interesting because of their very small external dimensions, measuring only 17 in. to the top of the bank. They are mounted on low pedestals on the concrete floor, the line conductors being dropped down from the buses above. The tie switch is arranged with an overload-release device designed to

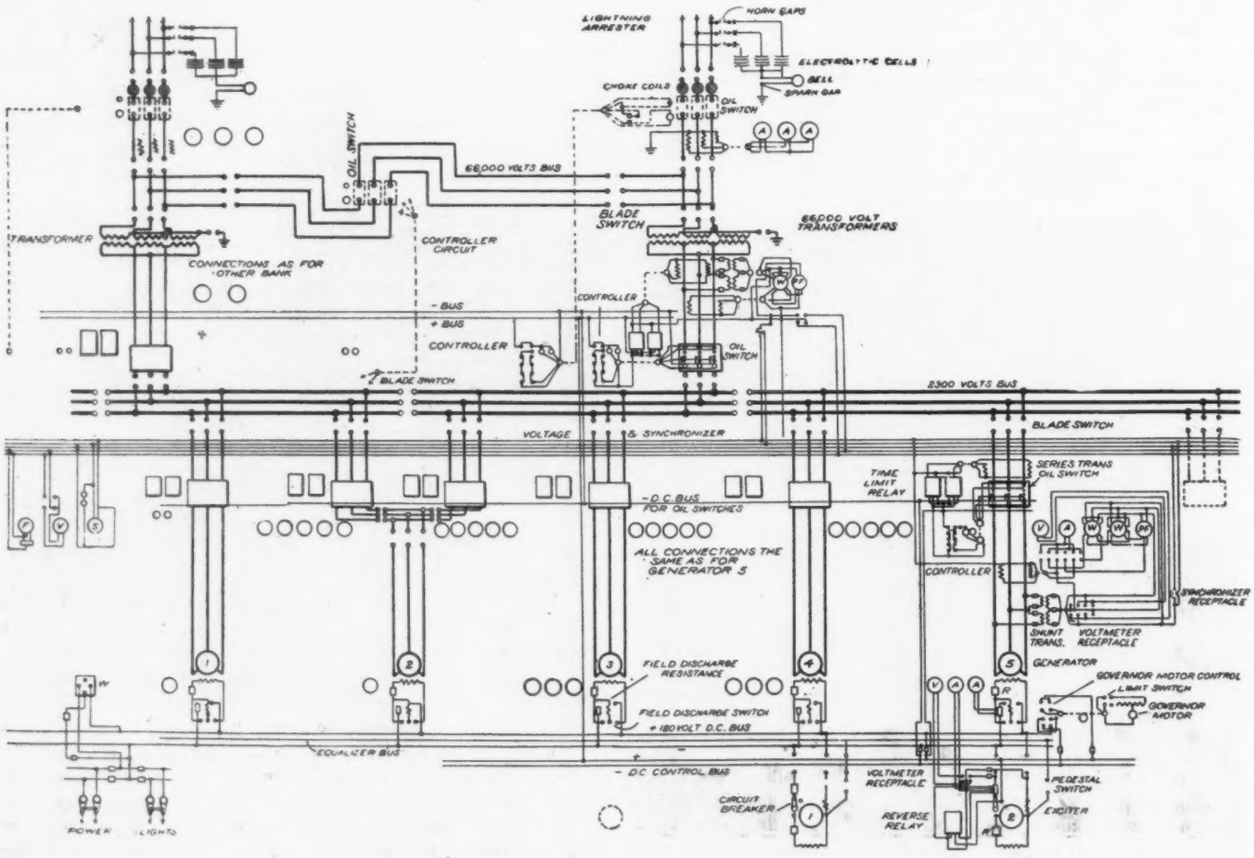


Fig. 9—Diagram Showing Electrical Connections.

trip the holding latch in case excessive currents are exchanged between the high-tension bus sections. The 66,000-volt switches, together with the high-tension series transformers, are inclosed in wire caging so that accidental contact is impossible. From

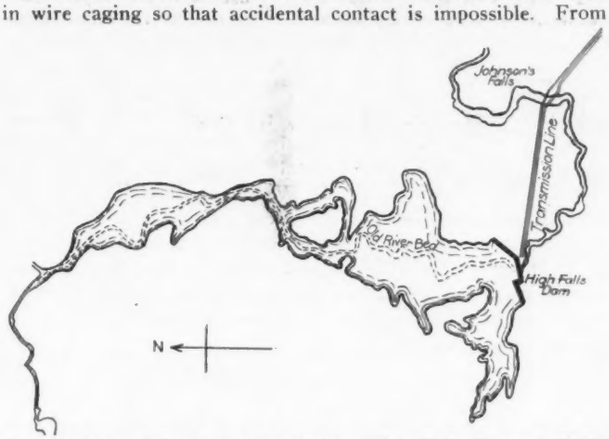


Fig. 10—Map of Poundage Created by High Falls Dam at 85-Ft. Level.

the oil switches the outgoing lines are carried through the choke coils, also of Swedish iron, and out through the second-floor entries, protected by molded concrete hoods, to the copper line wires, as shown in Fig. 2. The line wires, as before explained, are carried down to the horn-gaps mounted on brackets outside the building wall, and thence through the first-floor entries to the Westinghouse aluminum-cell lightning arresters. An alarm gap in the ground path of these arresters is shunted across a bell on the switchboard gallery, which rings when the arresters are discharging. Throughout both the 66,000-volt and 2300-volt circuits hook-type disconnecting switches have been inserted at all points where it is necessary to have access to high-potential apparatus.

The control of the station apparatus is effected from a switchboard on the gallery floor overlooking the generator room. The black-slate board comprises five generator panels, two line panels, two exciter panels and two station distribution panels for controlling the various motor and lighting services about the plant. The generator panels include the wattmeters, power-factor meters, voltmeters, field ammeters, governor control switches, generator-switch remote-control contacts and plug jacks for connecting in the frequency meter and synchroscope mounted on a swing panel at the right of the board. The Cutler-Hammer field rheostats are mounted over the switchboard, and are manipulated through sprocket chains from the handles on the generator panels. The two line panels carry the remote-control contacts for the high-tension and low-tension transformer switches and line tie switch, the high-tension ammeters, etc. Besides the exciter panels and the distributing

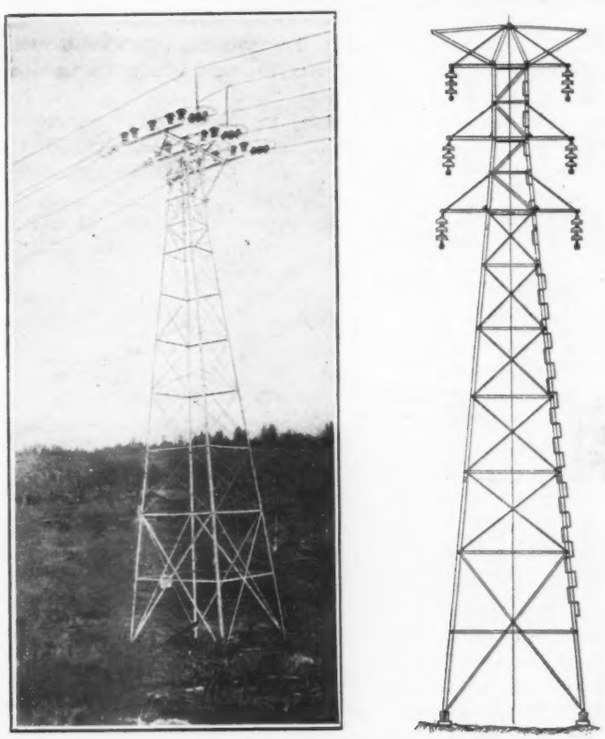
Fig. 11—Fox River Crossing at Transmission Line Into Green Bay.

panels for the motor and lighting circuits, which are taken off of the 120-volt exciter buses, extra black panels are installed for a future motor-driven exciter set and for the additional two 1000-kw turbo-alternators which the plant will ultimately contain. All of the switching and control apparatus, with the exception of the 66,000-volt oil switches before referred to, was built and installed by the Westinghouse Electric & Manufacturing Company.

Special attention has been paid to the interior illumination of the plant. The generator floor is lighted by eleven clusters of four 60-watt tungsten lamps mounted on the ceiling. In lighting the switchboard gallery care was taken to place the lamps so that glare and reflection on the instrument glasses would be avoided. The lamps are inclosed in Holophane globe reflectors, mounted well above the switchboard level.

TRANSMISSION LINE.

The 66,000-volt transmission line into Green Bay, sixty-two miles distant, parallels throughout its southernmost fifty-mile section the track of the Chicago, Milwaukee & St. Paul Railroad, leaving the railroad at Left Foot Lake and striking off twelve miles through the country to the falls site, over a 50-ft. cleared right-of-way. The two transmission circuits of three six-strand hemp-center copper cables, equivalent to No. 0 in conductor section, are hung on suspension-type insulators from



Figs. 12 and 13—Transmission Tower.

the cross-arms of 60-ft. steel towers. Each of these four-legged Aermotor towers, built of angle-steel sections, weighs 3000 lb. They were erected by bolting each leg onto steel angles set in concrete pedestals 9 ft. long and 20 in. in diameter at the base, which had been previously buried, guided by a template. On the tangent sections these pedestals weigh about 350 lb. each, while the larger anchors used for the angle towers weigh 1100 lb. each. The towers are erected at average intervals of 520 ft., or ten to the mile, 636 towers having been required for the sixty-two-mile line. The three wires at 6-ft. vertical distances on each side of the pole comprise each of the two circuits, and when the lines are paralleled in operation wires at the same level are at the same potential. The conductors are hung from three-disk Thomas suspension-type insulators, each disk having been individually subjected to 75,000 volts dry test and 50,000 volts rain test. Inclined arms at the top of the pole carry the two No. 2 equivalent, copper-clad steel ground-wires 4 ft. above and slightly outside the topmost of the line wires. From the peak of the pole there also rises a 3-ft. pointed lightning rod.

Besides being set in concrete pedestals each tower is addi-

tionally grounded through a copper jumper to a 15-ft. 2-in. x 2-in angle iron driven its full length into the earth. The lowest cross-arm is 40 ft. above the ground, and at the center of the 500-ft. spans is designed not to come within 20 ft. of the ground. In designing the spans a liberal factor of safety has been allowed, beyond assuming such severe conditions as 100 deg. Fahr. summer temperature and —20 deg. Fahr. winter temperature, with a seventy-mile wind and 0.5 lb. of sleet per foot of conductor. The longest span on the line is 800 ft., where a wide valley is crossed.

Leaving the High Falls generating plant the transmission line cuts across a bend in the Peshtigo River, crossing it at the site of the Johnson's Falls development. Here the two circuits are separated onto separate poles, passing on each side around the power-house site and joining again beyond. Pole-type disconnecting switches are inserted in the separate lines at this point, which, with the lines from the Johnson's Falls plant that are to be taped into the main lines on each side of the disconnecting switches, will enable the two generating stations to be paralleled or each to transmit singly into Green Bay, as desired. Paralleling the transmission line is a private telephone line carried on wooden poles. Other connection is provided with the Bell system through a line from High Falls of Crivitz.

Entering the City of Green Bay, the transmission line crosses the Fox River between two 185-ft. special steel towers, the lowest of the 563-ft. spans being 155 ft. above the surface of

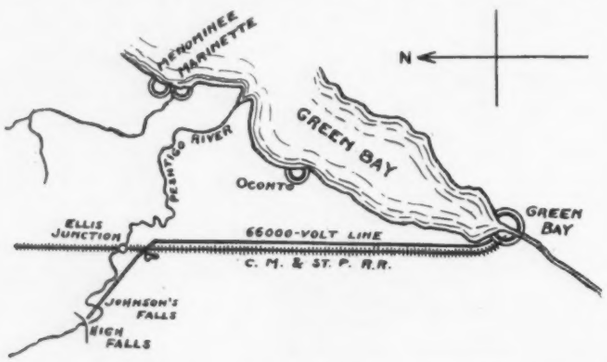


Fig. 14—Map of 66,000-Volt Transmission Line, High Falls to Green Bay.

the water, as required by the navigation laws. These towers have 50-ft. x 60-ft. bases and each contains 56 tons of steel. Besides the six 66,000-volt line wires and two ground wires, a 15,000-volt, three-phase line from the Green Bay substation also crosses the river here to the railway substation at Wrightstown.

The former steam equipment of the Green Bay Gas & Electric Company and the Green Bay Traction Company has now been relieved of service, but will be reserved for relay duty in connection with the operation of the transmission line. This steam-driven apparatus comprised two 500-kw, cross-compound Corliss engines driving 360-volt, 25-cycle, three-phase alternators, and a 500-kw, 60-cycle turbine-alternator set. The station equipment consisted of one 250-kw frequency-changer set for the lighting service and two 500-kw rotary converters for the railway load. To this has been added the 5000 kw in step-down transformers from the incoming 66,000-volt transmission line; two 350-kw banks of 15,000-volt transformers for railway transmission to Wrightstown (where there are two 300-kw rotary-converter sets) and a 500-kw frequency-changer set.

The high-tension panel at the Green Bay substation is equipped with reverse-power relays so that if the two transmission lines are operating in parallel and one goes out it will be automatically disconnected without shutting down any synchronous apparatus or interfering with the other line's operation.

There are 1200 lighting and motor-service customers in Green Bay. The two present largest consumers are paper mills, each with 500 hp in 440-volt motors, a demand which continues throughout the twenty-four hours from Monday morning at 7 o'clock to Sunday morning at 6 o'clock. There are a number of other factories and mills in the city that will in time become consumers of hydroelectric energy. It is planned to extend the transmission line to other manufacturing cities south of Green Bay, where there will be additional demand for energy.

The High Falls and Johnson's Falls water-power developments are owned and operated by the Northern Hydroelectric Company, of which Mr. F. Josslyn is president, Mr. L. E. Myers vice-president and general manager, and Mr. L. N. Boisen superintendent. Prof. D. W. Mead, consulting engineer, designed the High Falls development and supervised in part its construction, his resident engineer on the work being Mr. W. Reineking. The L. E. Myers Company, of Chicago, constructed the transmission line and has fulfilled certain contracts on the hydroelectric features under the direction of Mr. C. E. Collins, superintendent.

ELECTRIC DRIVE AS AFFECTED BY INCORRECT MOTOR SIZES.

By Morse O. Dellplain.

To be entirely successful the electrification of an industrial plant should mean (1) a minimum investment, (2) a reasonable maintenance cost, (3) reliable service and (4) an efficient use of energy. The attempt to electrify industrial plants without a proper regard to each of these items and their relation to

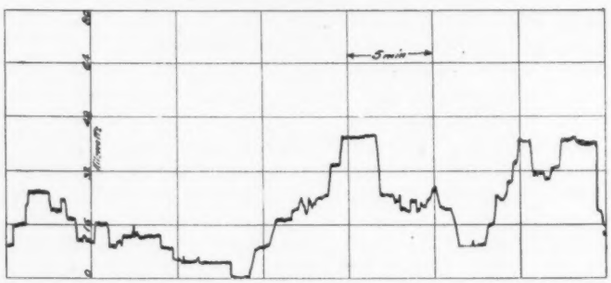


Fig. 1—Graphic Wattmeter Test Record on a 55-hp, 14-Pole, 60-Cycle Slip-Ring-Type Motor Driving Wire-Drawing Machines.

each other is responsible to a large extent for some of the poor results obtained in the past, and only by having the matter in charge of a person thoroughly familiar with the practical operating characteristics of electrical apparatus can it be expected that these essential features will receive their proper individual consideration.

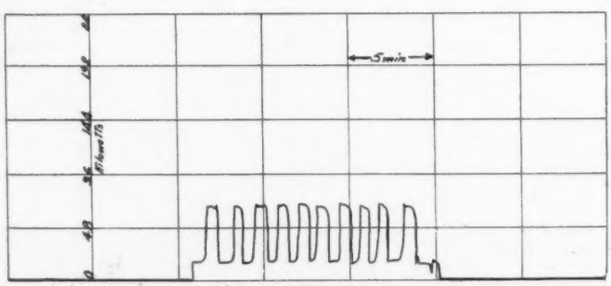


Fig. 2—Test Record on a 25-hp, 12-Pole, 60-Cycle Variable-Speed-Type Motor Driving a Bar-Drawing Machine.

In comparatively few cases is the electrification problem placed in the hands of a competent industrial engineer, it being left too often with the shop foreman or local millwright, who, aided perhaps by a hasty review of the machinery catalogs, invariably "plays safe" and installs motors much larger than necessary for the service. The result of this disregard of the items of investment and efficient use of the energy is an abnormally high charge against the power account and a conse-

quent poor showing for the electrified plant as compared with the old layout.

The over-motoring of industrial plants has become so common and its effects so uniformly detrimental that the co-operation of industrial engineers, apparatus manufacturers and central-station managers can well be solicited with a view to overcoming this erroneous tendency.

The consulting engineer, however conscientious, is seriously handicapped in his efforts to overcome this general tendency, for the reason that in the cases where supervision of the electrification of a plant is given to a competent consulting engineer his supervision is usually retained only during the initial lay-

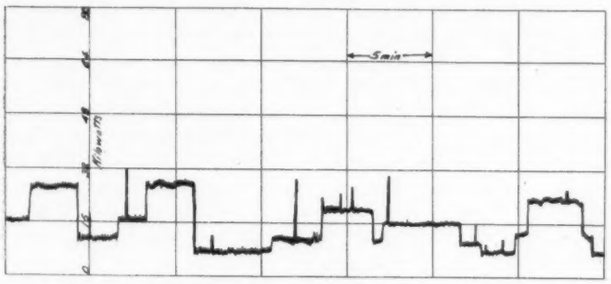


Fig. 3—Graphic Wattmeter Test Record on a 75-hp, 10-Pole, 60-Cycle Slip-Ring-Type Motor Driving Wire-Drawing Machines.

out, all future changes being beyond his control; he is thus forced in self-protection to recommend a high factor of safety with regard to motor sizes.

Manufacturers of electrical apparatus have done much in the past few years to correct the evil tendency by maintaining well-equipped industrial engineering departments which are always at the service of the prospective buyer; in addition to this, their salesmen carry carefully compiled data as to the proper sizes and applications of motors. Even this can only partly remedy the conditions, as the manufacturers find themselves continually forced to protect themselves against a demand on the part of the prospect for an unqualified guarantee covering the recommendations made by their representatives.

A well-organized power department as part of the new-business organization of central stations having a power field offers perhaps the simplest and surest solution of the problem. The central-station representatives, being in daily touch with the local industrial world and keeping careful watch of individual operating conditions, can make recommendations as to motor

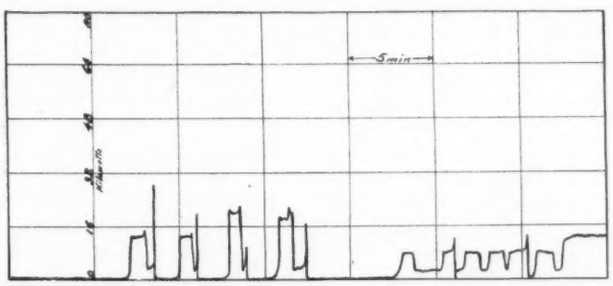


Fig. 4—Graphic Wattmeter Test Record on a 35-hp, 12-Pole, 60-Cycle Variable-Speed-Type Motor Driving Bar-Drawing Machine.

sizes more in accord with the actual service requirements and at the same time be prepared to guarantee these recommendations without fear of unfair future developments. Consulting engineers and apparatus salesmen thus find it advantageous to confer with the local central station with regard to any new electrification in the territory, thereby securing access to complete and accurate information regarding the operating conditions of that particular plant, the data probably having been compiled from observations and tests actually made by the central-station engineers in that plant or in similar plants. Whether an isolated plant be determined upon or central-station power purchased, the advantage derived by the client from this co-operation is equally manifest, the important result being an example of a properly electrified industrial plant.

Since central stations are so logically the branch of the electrical fraternity in best position to exert a correcting influence in the matter of improper electrification, and, furthermore, are the ones to reap the greatest benefit through improved power-factor conditions and satisfied consumers, it is not surprising to find that up-to-date central stations throughout the country are maintaining well-equipped power departments which endeavor to oversee the electrification of both old and new industrial plants with a view to having them become profitable consumers of central-station power. Often a central station finds it desirable to go over a plant already electrified and correct errors made in the original layout, thus making the electrical

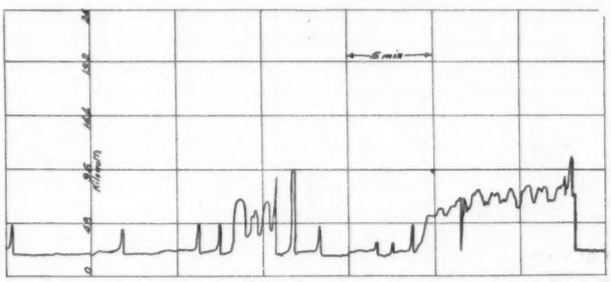


Fig. 5—Graphic Wattmeter Test Record on a 15-hp, 6-Pole, 60-Cycle Squirrel-Cage Motor Driving Wood-Working Machinery.

conditions of that plant more satisfactory to both the consumer and the central station.

A bit of industrial engineering of this nature has recently been completed by the power department of the Syracuse (N. Y.) Lighting Company at the plant of a local steel company which, when first built, was laid out almost entirely for electric drive to be operated with central-station power at 220 volts, three-phase, 60 cycles. In laying out the equipment originally entire stress seems to have been placed on having the motors large enough, the result being a motor in practically every case from 100 per cent to 200 per cent larger than necessary. The consequent low operating efficiency and power-factor entailed such a continued loss to both consumer and central station that it was decided to correct the existing conditions, and with this in view a complete test was made on each of the forty motors in the plant.

The motors, aggregating over 1300 hp, ranged in sizes from 2 hp to 200 hp, and the tests were made with a graphic recording wattmeter having 12 in. per hour paper feed, the high-speed

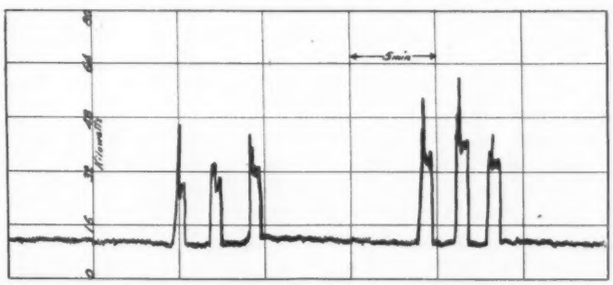


Fig. 6—Graphic Wattmeter Test Record on a 200-hp, 12-Pole, 60-Cycle Squirrel-Cage Motor Driving a 14-Reeler.

paper feed having been chosen in order that a test record might be secured sufficient in detail to insure an intelligent selection of the proper size and type of motor for each service. Each motor was tested under the severest load conditions, and in selecting the new motor due consideration was given to the low efficiency at which the tested motor was operating and also to the relation of maximum load to average load, the good overload characteristics of induction motors being always kept in mind. Continuity of service was not overlooked nor was the abnormally severe service to which machinery in general is subjected in a steel mill lost sight of.

Changes in the distribution system of the central station made it possible to change the frequency at this plant to 25 cycles, making the electrification more nearly ideal from a steel-mill

standpoint. Copies of the graphic wattmeter charts here given suffice to show the average conditions as found and it is needless to detail the improvement in both operating efficiency and power-factor derived through the changes in motor sizes.

The motors for which power-demand charts are shown in Figs. 1 to 6 were the ones originally installed and all were arranged for 60-cycle operation. The motors for Figs. 1, 4 and 5 had twelve poles each, Fig. 2 ten poles, Fig. 3 fourteen poles and Fig. 6 six poles.

The motors which replaced these six each have four poles and are designed for the new 25-cycle circuit. The same type of motor was used except in the case of Fig. 1, where a slip-ring motor replaced the former squirrel-cage machine. The sizes were cut down as follows: 200 hp to 50 hp, 75 hp to 35 hp, 55 hp to 35 hp, 35 hp to 25 hp, 25 hp to 15 hp and 15 hp to 7½ hp.

Investigations and electrification analyses, such as described above in plants, both old and new, together with a thorough co-operation between industrial engineers, whether acting in a consulting capacity or as representatives of manufacturers or central stations, cannot fail to bring about a more careful selection of motor sizes with the consequent improvement in electric drive conditions in industrial plants throughout the country.

A CHEMICAL SPECIFICATION FOR RUBBER-COVERED WIRES AND CABLES.

By C. R. Boggs.

In recent years there have been in use many specifications for high-grade rubber compounds used on insulated wires and cables which have included chemical tests. There has been some improvement in these tests, but a want of standard methods of analysis has always been felt. A difference of opinion has often arisen between the purchaser and the manufacturer as to whether the rubber met the specifications, each relying upon the report of his chemist; and sometimes this has led to serious misunderstandings. The fundamental cause of these differences of opinion has been the different methods employed by the chemists, the use of which was made possible by the lack of any specified methods. To complicate matters it has been the tendency of the purchaser to accept the report of his chemist as final without the manufacturer knowing either the chemist or his methods. The fair adjustment of such a difference of opinion would have been to use that method which the purchaser and the manufacturer had in mind when the specification was drawn up and accepted. New methods which show unexpected results, even though more correct, should not be used when neither purchaser nor manufacturer ever realized that such results could be obtained from that class of compounds.

Such differences of opinion could be entirely avoided if there were adopted a standard method of analysis, including definite details of chemical procedure and interpretation of results and excluding general statements, such a specification to hold in all its details until experience demonstrated that changes would make an improvement.

As in other cases, the Germans have led the way in the adoption of such a specification. About a year ago their association of United Cable Manufacturers and the Royal Association for Testing Materials[1] agreed to a specification for the analysis of one class of rubber compounds which includes all the chemical details of procedure and interpretation of results. The specification also more nearly approaches that ideal condition under which the final product is tested for its value alone and the manufacturer is not limited with detail instructions of how that product shall be made.

The specification could be utilized in this country for the same class of compounds by changing some of the details and fixing the limits to suit the case. The details are not perfect and the results obtained can probably be criticised, but the form of the specification with its exact directions is the essential point. I have checked up the methods in the laboratory of the Simplex Electrical Company and the results are as good as by most methods and decidedly better than those by the methods in common use. The specification follows:

Scope of Tests.—The composition of the rubber compound on the normal wire shall be as follows: 33.3 per cent rubber, which shall contain not more than 4 per cent resin; 66.7 per cent fillers, including sulphur. Ceresin (paraffine hydrocarbons) is the only organic filler allowed, and that only up to 3 per cent. The specific gravity of the compound shall be at least 1.5.

The above specifications shall be applied to the rubber compound after stripping off the covering, whether or not the compound has been changed in its chemical composition by the impregnating mixture of the covering.

The tests shall include: (1) Determination of specific gravity. (2) Qualitative test for mineral oils, asphalts and similar substances. (3) Determination of the acetone extract; in the latter shall be determined (a) ceresin (paraffine hydrocarbons) and the sulphur held in it; (b) the sulphur in the total acetone extract. (4) Determination of the fillers. (5) Determination of the constituents soluble in one-half normal alcoholic sodium hydroxide.

The tests are discontinued if the compound fails to meet any one of them. If the specific gravity is below the limiting value, the chemical tests are nevertheless continued.

PROCEDURE FOR TESTS FOR RUBBER COMPOUND USED ON INSULATED WIRE.

Preparation and Taking of Sample.—At least 30 gr. of the compound is taken for the test. As this sample is to be taken from the finished wire, enough of the wire shall be submitted to the office to enable 30 gr. of the rubber compound to be taken for the analysis. The compound shall be cut into cubes of 0.5 mm to 1 mm on an edge.

1. *Determination of Specific Gravity.*—The expression "specific gravity" is used here in the sense of volume weight. The compound to be tested must sink in a zinc chloride solution of specific gravity 1.49 at 15 deg. C.

2. *Qualitative Test for Mineral Oils, Asphalt and Similar Substances.*—The solution formed by allowing the sample to swell up in solvents, as xylol, carbon tetrachloride, pyridine, nitrobenzol, shall show neither fluorescence nor dark color. The test is carried out at room temperature.

3. *Determination of Acetone Extract.*—Two samples of 5 gr. each are extracted on a water bath for ten hours in a Soxhlet apparatus, excluded from light (with freshly distilled acetone). The acetone is then distilled from the flasks. The residues in the flasks are dried to constant weight in a steam drying oven and weighed. One of the two extracts is treated with 50 c.c. warm absolute alcohol, filtered and washed with 25 c.c. boiling absolute alcohol. The filtrate is placed for one hour in a freezing mixture at —4 deg. C to —5 deg. C., and is then filtered immediately and washed with about 100 c.c. of 90 per cent (by volume) of alcohol cooled to the same temperature. A part of the sulphur present in the acetone solution remains on the filter. The filtrate is cooled once more to test for the presence of paraffine hydrocarbons. The residue on the filter is dissolved back into the flask used, first with alcohol and then with warm carbon bisulphide, the solvents evaporated and the residue weighed after drying at 100 deg. C. For the determination of the sulphur contained in the paraffine hydrocarbons the mixture of paraffine and sulphur in the flask is heated to weak boiling for one-half hour with about 20 c.c. conc. HNO_3 (specific gravity 1.48), diluted with 100 c.c. water and filtered cold. The filtrate is evaporated to dryness in the water bath with the addition of some crystals of sodium chloride and the residue boiled down with 5 c.c. conc. hydrochloric acid.

After diluting to 50—100 c.c. the sulphur is precipitated with barium chloride in the regular way. The other acetone extract is used for the determination of the entire free sulphur present in the acetone extract according to the procedure given above.

[1] *Mitteilungen des Kgl. Material-prüfungsamtes*, 1909, 465. *Elek. Zeit.* XXX., 50, 1205. *Chem. Ztg.*, 34, 184.

The other substances of the compound soluble in the acetone are considered rubber resins and can be calculated from the results obtained.

4. *Determination of Fillers.*—That amount of the acetone extracted sample is taken which corresponds to 1 gr. of the original sample and dried at 50—60 deg. C., put into a weighed 100 c.c. Erlenmeyer flask provided with an air condenser, with 25 c.c. petroleum (230—260 deg. C. fraction) and boiled in a paraffine bath until the rubber is dissolved.[2] After cooling the flask is nearly filled with benzol and the precipitate allowed to settle twenty-four hours. The supernatant liquid is decanted on to a weighed Gooch crucible provided with double filter papers and suction applied[3]; the liquid is continually poured through until it comes out perfectly clear. The contents of the flask and the residue on the crucible are repeatedly washed with hot benzol until the filtrate comes through colorless; then the crucible and flask are washed with petroleum-ether, alcohol and ether and dried at 105 deg. C. If a centrifuge is available decanting with the help of the centrifuge is preferable, as this accomplishes the purpose more quickly.

After evaporating the rest of the wash liquids by drying at 105 deg. C. to constant weight the flask is weighed. By the above described procedure organic fillers insoluble in petroleum, as lampblack, cellulose, etc., are included with the mineral matter. The sum of the fillers thus determined, plus the free sulphur and paraffine hydrocarbon, shall not exceed 65.7 per cent. The difference between this and 100 corresponds to vulcanized rubber. The per cent of pure rubber of the compound shall be calculated by subtracting 1 per cent as an average value for combined sulphur, calculated on the compound. (The direct determination of combined sulphur is omitted for the present to avoid the otherwise disproportionate increase in cost of the test.)

5. *Determination of the Constituents Soluble in One-Half Normal Alcoholic NaOH.*—The acetone extract sample is dried in a drying oven at a low temperature (50 to 60 deg. C.), taken out of the Soxhlet thimble and put into a small Erlenmeyer flask (100 c.c.), 50 c.c. of one-half normal alcoholic NaOH added and boiled on a water bath with reflux condenser for four hours. The solution is filtered into a beaker, washed first with 100 c.c. hot absolute alcohol and then with 50 c.c. hot water evaporated to about 15 c.c., put into a separatory funnel, diluted with about 100 c.c. water, acidified with dilute H_2SO_4 and shaken out with ether. The solution of ether, alcohol and water is evaporated off carefully, without boiling if possible, in a weighed beaker covered with a watch glass, dried to constant weight and weighed. In view of the fact that pure rubber may contain a certain amount of substances soluble in alcoholic NaOH, as high as 0.5 per cent of the weight of the compound is allowed.

CEMENT CONCRETE VATS AND TANKS.

Impervious, odorless, tasteless and sanitary vats and tanks for oil, and for buttermilk, wine, pickles, sauerkraut, etc., can be constructed of reinforced concrete, the reinforcing to be designed by a competent engineer, provided the interior surfaces are treated as follows:

After the forms are removed, grind off with a carborundum stone any projections due to the concrete seeping through the joints between the boards. Keep the surface damp for two weeks from the placing of the concrete. Wash the surface thoroughly and allow to dry. Mix up a solution of one part water-glass (sodium silicate), 40 deg. Baumé, with four to six parts water, total five to seven parts, according to the density of the concrete surface treated. The denser the surface the weaker should be the solution.

Apply the water-glass solution with a brush. After four hours and within twenty-four hours wash off the surface with clear water. Again allow the surface to dry. When dry apply another coat of the water-glass solution. After four hours and within twenty-four hours again wash off the surface with clear water and allow to dry. Repeat this process for three or four coats, which should be sufficient to close up all the pores.

The water-glass (sodium silicate) which has penetrated the pores has come in contact with the alkalies in the cement and concrete and formed into an insoluble hard material, causing the surface to become very hard to a depth of ⅛ in. to ½ in. according to the density of the concrete. The excess sodium silicate which has remained on the surface, not having come in contact with the alkalies, is soluble, therefore easily washed off with water. The reason for washing off the surface after each coat and allowing it to dry is to obtain a more thorough penetration of the sodium silicate.

It is obvious that concrete surfaces so treated if hard, impervious and insoluble have been made also tasteless, odorless and sanitary.

[2] In case petroleum does not completely dissolve the rubber, other solvents, such as camphor oil or paraffine oil, may be used.

[3] The filter papers are pressed on moist and then dried by washing with alcohol and ether.

INFLUENCE OF SIZE ON THE COST OF AN ELECTRICALLY DRIVEN TEXTILE PLANT.

A recent report upon the cost of a hydroelectric textile development in the southern Appalachian district by the engineering firm of Lockwood, Greene & Company, Boston, illustrates the marked effect which an increase in the size of a mill has upon the investment and annual operating expenses per unit of power. The report was made on the construction of a cotton mill in conjunction with the electric power development for its operation, and the development necessitated the construction of a dam, a power house, a short transmission line and the mill. Investigation showed that the primary power (ten-hour power) available was 800 hp at the generator terminals, and that 95 per cent of the time 1000 hp, 60 per cent of the time 1700 hp and 55 per cent of the time 2000 hp will be available. Any mill development in excess of 1000 hp required an auxiliary steam plant. The estimates were based on a 21-ft. fall, although under normal conditions the fall is 22 ft.

The proposition resolved itself into five definite possibilities, as follows:

(A) A development of 10,000 spindles with a wooden dam.
(B) A development of 10,000 spindles with a concrete dam.
(C) A development of 25,000 spindles with a wooden dam.
(D) A development of 25,000 spindles with a concrete dam.
(E) A development of 50,000 spindles with a concrete dam.

The accompanying table shows the estimated unit costs and the estimated yearly cost for power under these various developments:

TABLE I.—ESTIMATED COST PER SPINDLE.

Development.	No. Spindles.	Type of Dam.	Hp Required.	Total Cost per Spindle, Cents.	Operating Power, Cost per Hp per Year.
A	10,000	Wood	500	35.58	
B	10,000	Concrete	500	38.00	$22.49
C	25,000	Wood	1,000	26.10	
D	25,000	Concrete	1,000	27.05	13.12
E	50,000	Concrete	2,000	24.80	

Regarding the question of the adoption of a timber or a concrete dam it was considered unnecessary to go beyond a comparison of the estimated costs per spindle.

The large difference between the yearly power costs of developments B and D is caused by the fact that the cost of the dam for either size of development is the same. The power costs given here include administration, maintenance and repair, interest on investment at 6 per cent, taxes and depreciation.

The textile machinery costs were based on a gray goods 36 in. wide product to be manufactured of about No. 24 or No. 26 yarn, sixty-four square or thereabouts.

It is proposed to locate the mill on a plateau 100 ft. above the

river, where there is sufficient room for future development and where there is a perfect drainage. Electrical power transmission makes it possible to utilize the very best location available for the mill. The above costs were based on the adoption of concrete as the construction material for the mill. A quotation from the engineer's report will show how the local conditions favored this type of construction:

"The type of construction to be used in the mill has received considerable thought. The bricks which are made locally are of rather poor quality and we do not recommend their use, and as all materials except sand and stone to be used in the construction will have to be hauled a distance of fourteen miles the use of timber interior construction is not recommended at this time, though more detailed study of this feature may lead to a change of view. There is in the immediate vicinity of the proposed development a large amount of heavy oak timber, but this is not a desirable material for mill construction, although it could be used in the construction of a timber dam. It, therefore, appears to us that the mill might properly be constructed of reinforced concrete and the estimates have been made upon this basis."

In view of the facts given above the engineers recommended an initial development of not less than 25,000 spindles with the power house designed for an ultimate increase to 50,000 spindles.

Central Station

Management, Policies and Commercial Methods

CENTRAL-STATION STORES BUILDING AT OKLAHOMA CITY.

A large two-story brick addition to the power house of the Oklahoma Gas & Electric Company is being completed by the H. M. Byllesby Company, which controls the former concern. The annex will serve as an apparatus storeroom and employees' quarters. The new building is 75 ft. x 150 ft. in ground plan and has a wagon driveway running throughout its length. Adjoining this on the first floor are the employees' lockers and the heavy-apparatus storerooms, with a machine shop at the rear of the building. On the second floor are the offices for the superintendents of departments, a meter storeroom, a meter-testing room and the employees' dining-room and library. Adjoining the new store's building is a garage for the use of the company's automobiles. The generating capacity of the Oklahoma City plant is also being increased by the addition of a 2000-kw engine-driven unit.

COMBINED ADVERTISING CARD AND INQUIRY BLANK.

The Union Electric Light & Power Company, of St. Louis, is distributing a display card which is unique in bearing a pad of tear-off inquiry blanks in the form of postal cards. The card is 11 in. high and 21 in. wide, and may be displayed in any prominent position, as in a street-car advertising panel. It is printed in colors, representing a man and his wife enjoying the benefit of electric light over the living-room table. The lettering on the card first states that "Electric light makes day of night," and then proceeds to ask, "Have you Union electric light in your home?" If the answer is in the negative, the reader is urged to use electric light for sixty days on trial, and is asked to tear off a card for full particulars.

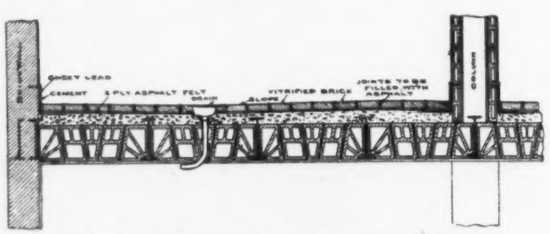
On tearing off a card it is seen to be a postal card (unstamped, of course), addressed to the Union company. On the "message" side of this card the company offers to loan electric globes, inspect house wiring and make free outside wire connections to any residence on its lines on sixty days' trial. At the end of the trial period, if the service is not satisfactory, the company will take back the lamps and disconnect the wires, charging only at the regular rates for the electricity used. If the prospective customer's house is wired, but no fixtures are installed, the company will furnish six electric-light fixtures complete for $12.63, giving the customer a year to pay for them. If the house is not wired, the company will wire it for electric-light service, with one fixture outlet in each of five rooms, for approximately $18, additional fixture outlets to be supplied at a proportionate advance. A year will be allowed for the payments for this work also. If the trial service is satisfactory the company charges 15 cents each for the 16-cp lamps supplied, with free renewals thereafter. Space is left at the bottom of the card, so that the recipient may give his name and address and mail it to ask for an application blank.

HOUSE WIRING DURING THE DULL MONTHS.

The months of January and February are usually dull ones in a business way for the electrical contractor as well as for the central-station company. The Janesville Electric Company, Janesville, Wis., takes advantage of this slack season to offer its "fourteen-dollar" house-wiring proposition to intending users of electricity. This offer is for equipping five outlets, two two-lamp fixtures and three single-lamp cords or wall outlets. The price of $14 is divided equally between the contractor and the lighting company, the former receiving $7 for his work and materials and the latter the same amount for the plain fixtures furnished. Although the special rate made represents a substantial decrease in the ordinary charge for the same material, a satisfying number of prospective consumers usually take advantage of the low figure and have their houses wired. The electric light company has the satisfaction of adding these installations as new business, while the contractor usually finds that the house owner desires several little extras, such as additional outlets, switches, etc., out of which he can secure a margin of profit.

STATION FLOOR CONSTRUCTION FOR STORAGE BATTERIES.

In a recent address on modern fireproof building construction delivered before the Commonwealth Edison branch of the N. E. L. A., Mr. N. A. Rollins, of the Commonwealth company,



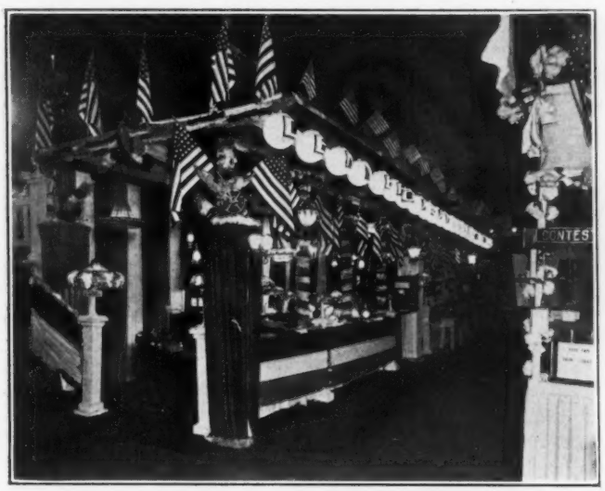
Details of Battery-Room Floor Construction.

gave some information on the erection of floors for storage batteries, where, owing to the presence of sulphuric acid, special work obtains. A concrete floor is laid over the terra-cotta work with ridges and valleys to give proper drainage. All steel columns passing through this floor are protected by sheet lead

carefully placed around the fireproofing, and the lead carried up on the face of the column and turned into the plaster. This lead is carried out on the floor around the columns, the concrete having been left 0.25 in. lower at this point for this purpose. All the joints in the sheet lead, as well as the joints in the lead pipe from the floor drain, must be burned, as joints made with solder will be readily attacked by the battery acid. After the lead work has been completed two-ply asphalt felt is laid over the entire floor, the joints being carefully mopped with hot asphalt filler, and then special vitrified brick is laid with 0.25-in. joints. The joints and all spaces around walls and columns are filled later with the same asphalt compound poured into the joints and spaces at a temperature of 450 deg. Fahr. The details of battery-room floor construction are shown in the accompanying engraving.

DENVER COMPANY EXHIBIT AT STREETS OF ALL NATIONS FAIR.

The Denver Gas & Electric Company made a very striking exhibit at the Streets of All Nations Fair which was recently held in Denver under the auspices of the Women's Club. The attendance during the week of this exhibition was 60,000 and the company thus had an opportunity of showing its exhibit to



Denver Company Exhibit.

a large number of people. The exhibit was specially interesting on account of the large number of applications made of gas and electricity which appealed to the ladies. Special prominence was given to the sewing-machine motor, the vacuum cleaner and similar appliances.

ATTENDANCE OF CENTRAL-STATION MEN AT COUNCIL MEETINGS.

To attend time after time the meetings of the town board or city council gets to be rather monotonous, but the manager of the electric plant in the small town who appears at such meetings frequently takes one of the best means possible of avoiding trouble and disagreeable controversies between his company and the municipality.

The natural tendency of some such boards seems to be to regard the public service companies in their jurisdiction as being organized expressly for the purpose of getting everything they can from the municipality and its citizens and of giving as little as possible in return. At times the spirit of antagonism so prevails in the council chamber that newly elected members speedily become possessed with antagonistic feelings for the company without themselves knowing why.

The appearance of a representative of the company at the meetings of the town board is the most effective means of keeping this antagonistic spirit out of the council or of routing it if it be present. At every meeting there are likely to come up for discussion questions regarding the relations between the company and the city. If no one is in attendance to present the company's side of the case, the councilmen may simply assume that the city is being abused and the discussion may take the form of a tirade against the corporation. With a representative present, however, all matters will, in all probability, be settled amicably.

The attendance of the manager at the meetings usually has a beneficial effect in another direction. Frequently the council meetings are attended only by the members of the board and by the few citizens who have matters to bring to its attention. In time the members develop a species of fraternal feeling among themselves and this feeling is to a greater or less degree extended to anyone who attends the meetings regularly and shows himslf interested in the matters discussed. When a lighting plant manager gets on such terms with the council that the members extend this feeling to him he may rest assured that the body will not misinterpret every act of his company, but instead will be inclined to view its actions in a favorable light until they are proved objectionable. This is, of course, conducive to a "pull together spirit" of inestimable value to the company.

SUCCESSFUL ELECTRIC COOK-STOVE CAMPAIGN.

For the past two years the Billings & Eastern Montana Power Company, Billings, Mont., has been conducting an active campaign for the introduction of electric irons, coffee percolators, chafing dishes, heaters, etc., but it was found that, aside from electric irons, less than 2 per cent of customers became interested in the appliances. It was also found that offering these articles at absolute cost was no inducement to the average consumer, for the reason that they are looked upon as luxuries and only for people who do not miss the money spent for appliances of that kind.

After a thorough investigation regarding the needs of the average consumer it was decided that what was required to introduce electric cooking was something along practical lines that would eliminate the drudgery and danger of the kitchen from the use of gasoline, kerosene and gas stoves. It was believed that with the electric iron and the washing machine placed in the kitchen it would not be a hard matter to introduce cooking by electricity, provided an efficient stove were available. After investigating the different stoves that had been placed on the market prior to June 1 the Hughes electric cook stove was adopted, a number were ordered and a campaign was immediately started to demonstrate to customers what could be done with the stove. As the campaign was not started until about July 1, part of the season for introducing an appliance of this kind was over. However, a ready sale was found for the stoves, and at the present time more than one dozen electric cook stoves have been placed and are doing good work, some customers going so far as to remove their coal ranges entirely with the intention of doing their cooking both summer and winter by electricity.

A rate of 5 cents per kw-hour is given for cooking under the following conditions: The stove is sold outright and connected by running a separate circuit for cooking. A customer for an electric cook stove is entitled to this same rate of 5 cents for his electric iron, electric washing machine, and, in fact, any other appliance, provided it is connected to this separate circuit, on which there is a separate meter. There is a minimum charge for this meter of $1 per month in order to protect the business already secured for electric irons. Where there is little current used on percolators, toasters, etc., the electric iron is the principal part of the appliance load of any central station, and, therefore, if any customer should dis-

continue the use of his stove at any time of the year and yet leave it connected in order to get the rate of 5 cents on his iron, the $1 minimum would give the same revenue that the central station was getting before the installation of the electric stove.

This kind of a rate also induces the people who have washing machines, electric irons and other appliances to install a stove in order to get the benefit of the 5-cent rate, as this rate applies only where there is an electric cook stove installed. The company has found the electric cook stove by far the best means of educating the people and making electricity in the home so popular that customers finally decide that it is an impossibility to get along without it. In fact, the central station can on this ground give a rate for electric cooking leaving a very small margin of profit.

Mr. J. F. Riche, manager of the company, to whom we are indebted for the above information, believes it would be well for the manufacturers of electrical appliances to look into the matter of electric cook stoves and awaken to the fact that with them they can cater to 100 per cent of the users of electricity instead of 2 per cent as they are now doing. With a thoroughly efficient electric cook stove and a heater that will enable the consumer to have hot water without having to use a coal or gas range, gasoline or kerosene stove, an important problem of the central-station man will be solved and his company placed in a much better light in the public eye.

DISCUSSION ON SIGN AND DISPLAY WINDOW LIGHTING AT THE ILLINOIS CONVENTION.

Mr. E. W. Osborn, advertising manager of the Rockford Electric Company, Rockford, Ill., presented a short paper before the convention of the Illinois State Electric Association at Rock Island, Oct. 26, on the above subject, which was followed by a free discussion.

Mr. Osborn said that successful merchants are using electric light liberally in store-window and sign illumination, and that the central station should lead the way by having an attractive display in its own window each week. One good plan is to loan the window free of charge to different concerns in the city for periods of a week. This creates a friendly feeling and also demonstrates how well advertising may be done by good illumination.

All sign and window lighting should be sold strictly as advertising and billed as such, separate bills being rendered for this service. If this is not done the merchant is likely to figure that he is spending too much for the lighting of his place. A good solicitor can readily show a merchant who is paying a high rent how he can increase the earning value of his location by well-lighted windows. The best method of securing this business is on a flat-rate basis from dusk until midnight, turned off and on by the company, which can be done by the installation of a lock switch on the front of the customers' premises. A check meter should always be placed on these circuits so if the sign man becomes negligent the leak can be stopped. In a city where the maximum rate is from 10 cents to 15 cents per kw-hour a rate around 6 cents can be safely figured on for the flat-rate business.

Since the introduction of the tungsten sign lamps the consumer can be given a much larger amount of sign and window lighting for the same amount of money. Sign and window lighting may be the opening wedge in securing the entire lighting of a customer's store, or it may mean the awakening of his neighbor. On the flat rate mentioned dusk-to-midnight signs and windows will be lighted about 2400 hours per year, and at 6 cents per kw-hour will earn $144 per kw-year. This 6 cents includes lamp renewals.

In discussion Mr. J. G. Learned, of the North Shore Electric Company, Chicago, emphasized window lighting as an entering wedge for other lighting inside the store. A storekeeper with electrically lighted windows and signs may direct trade to side streets off the main thoroughfares and increase the value of his advertising. Mr. Learned told of the flat-rate window lighting which his company is carrying on at a rate of 20 cents per 60-watt lamp per week, including lamp renewals.

Mr. T. W. Gregory, of East St. Louis, said that his company started flat-rate window lighting with free renewals of tungsten lamps. The free-renewal privilege was abused by customers working in lamps for renewal other than those furnished by the company for the window in question. As a result his company now makes a flat rate on such lighting for electricity only and the consumer must furnish his own lamps. Mr. Learned thought it necessary for the company to furnish the renewals in order to prevent some lamps being out and making a bad appearance and poor illumination. If left to the customer the renewals may not be made promptly. In order to prevent the abuse of the lamp-renewal privilege by customers working in other lamps, his company adopts a peculiar marking on the bulb of tungsten lamps used in show windows on a flat-rate free-renewal contract. If desired this could be further safeguarded by the use of a lock socket.

Prof. E. J. Burg, of Urbana, said that many streets have more traffic along one side than the other. It is possible by lighting to change the flow of traffic, particularly if the windows are filled with displays. Mr. R. S. Wallace, of Peoria, said this fact had been demonstrated in Peoria on a certain street. In this case it was the establishment of nickel theaters with their well-lighted fronts which changed the flow of traffic.

President E. W. Smith, of Kewanee, suggested to members a trial of the plan of lighting the windows and signs along one side of a street for a few nights and noting the number of people passing on the light side as compared to the dark side and then reversing this process. The result would be very convincing. He thought that the best plan of handling this business is to charge a flat rate of about 1 cent per watt per month, sell lamp renewals at cost and control the service by having the company's patrolman turn on and off at certain times. He had found by experience at Kewanee that this rate will give a return of 6.3 cents per kw-hour with the service turned off at 10 p. m. every night except Saturday, when it is run later.

Mr. N. M. Argabrite, of Belvidere, told of a plan for this class of business which consists of short lines of secondary circuits supplying signs and window lighting, operated by remote-control switches from the power plant, which open the circuits at 10 p. m. The rate on this service is 16 cents per watt per year. The service has been successful in meeting gasoline competition. He also told of the special street lighting installed along the main street in Belvidere. This consists of 10-watt tungsten 10-volt sign lamps placed about 5 ft. apart on No. 6 wires stretched between the poles along each side of the street. The average number of lamps per front foot is 4.5. The rate charged for this service is $1 per foot per month, which is about at the rate of 22 cents per kw-hour. The company, however, furnishes all the installation. He has materially changed the appearance of a street by inducing merchants to light their windows. One advantage of the flat rate is that it removes the temptation of a merchant to cut down on his lighting bills in the fall by turning off signs and windows when his bills increase, as they do when the hours of darkness are longer. Within the last week he said that he had closed contracts for 112 installations of display street lighting, which would net $112 per month.

HEAVY CENTRAL-STATION LOAD.

On Nov. 2, 1910, the maximum load on the electric service system of the Commonwealth Edison Company of Chicago reached a trifle over 165,000 kw. This is the greatest load ever carried by the Commonwealth Edison Company, and is believed to be the greatest load every carried by a central-station company anywhere up to this time. On the corresponding day in 1909 the maximum load of the Commonwealth Edison Company was 33,000 kw less.

A large proportion of the load carried by the Commonwealth company is due to the electrical energy supplied to surface and elevated electric railway companies. The Chicago company has

been notably successful in securing this class of business, selling large blocks of energy for this purpose at wholesale rates. A considerable proportion of the electricity taken by the railway companies is used in heating the cars, and it is a notable and interesting fact that a sudden drop in temperature as the season advances has a more decided effect on the central-station company's maximum load than does the increased demand for light owing to the shorter days of the fall and winter months.

ELECTRIC VEHICLES AT ROCKFORD, ILL.

Rockford, Ill., deserves to be classed as one of the "electric vehicle" cities of the country, for with a population of 45,000 no less than 170 electric automobiles are owned and operated in the city. Accounts of the work that has resulted in this record were given in our issues of Feb. 17, 1906, March 27, 1907, and April 1 and April 29, 1909, and what follows brings the subject up to date.

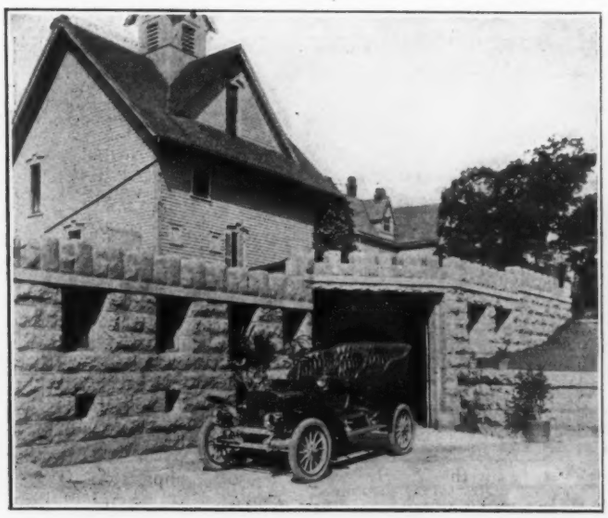
Rockford is not particularly favored with well-paved streets, but the situation has simply been one where the inherent characteristics of the electric vehicle have demonstrated it to be the logical car, and the appreciation thus secured has spread to other automobilists. Most of the electric automobiles are owned by persons having gas cars and who use the electrics when they want to get to some place without being bothered with the intricacies of the big gasoline machines.

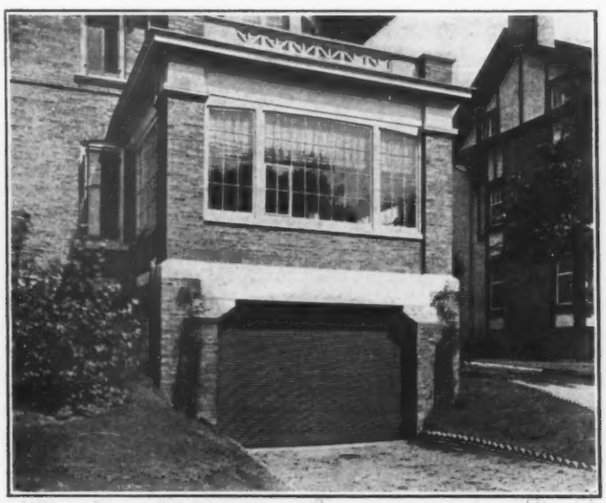
The introduction and operation of electric vehicles in Rockford has been assisted greatly by the very liberal rate which the Rockford Electric Company makes for charging service. The rate for this purpose to private consumers is 6 cents per kw-hour, measured under a separate meter from that registering the energy used for residence lighting, for which 13½ cents per kw-hour is charged. A minimum charge of $1 per month is made for the separate meter connection. The private consumer can utilize any demand he may require, but is limited during the winter months to taking service only outside of the peak hours, from 4:30 to 9 p. m. The average income from each machine is about $60 a year, or $5 a month, although, of course, the latter amount may vary greatly with the seasons of use of the car.

The majority of the electric vehicle owners in Rockford have built their own garages at their residences and many handsome and ingenious examples are visible in a few minutes' ride over the principal residence streets. Besides some of the really imposing structures used for electric garages, some owners have combined the garage with a porch or basement of the residence itself, making a compact and convenient arrangement. The accompanying views show several of these Rockford private garages.

Figs. 1 and 2—Private Electric Garages at Rockford, Ill.

There are ten public garages in Rockford, most of which have battery-charging facilities. One of these garages is exclusively for electric vehicles, repairing them and storing business men's runabouts during the day. Little or no "boarding" of automobiles is done in Rockford, as is the case in other





Figs. 3 and 4—Private Electric Garages at Rockford, Ill.

cities, although some owners keep their machines in their own barns, driving them into the garages for charging. The public garages purchase electricity from the central-station company at 4 cents a kw-hour, guaranteeing $5 minimum income from each charging plug connected.

All of the downtown distribution and much of the service in the outlying residential district is direct current, so that comparatively few owners have to purchase mercury-rectifier or motor-generator sets. The convenience and economy of having the direct current available, together with the low rate charged for it, are probably the most potent factors in the recognition which electric vehicles have received at Rockford.

Fig. 5—Electric Garage at Rockford, Ill.

Wiring and Illumination

ORNAMENTAL STREET LIGHTING AT BELVIDERE, ILL., BY LOW-VOLTAGE TUNGSTEN LAMPS.

A permanent ornamental street-lighting system employing low-voltage tungsten lamps suspended from catenary spans bordering the curb line has been installed at Belvidere, Ill., the merchants paying $1 per store front per month for the special illumination. An iron messenger cable is suspended between the various electric light and railway poles along the curb, and from this messenger the low-tension lighting mains, two No. 6 rubber-covered copper wires taped together, are supported at a uniform height of 12 ft. above the pavement by drop hangers of suitable lengths. Ordinary weatherproof sockets are attached at 4-ft. intervals, each containing a 10-watt, 8-cp Buckeye tungsten 12-volt lamp. Mounted on the poles at intervals sufficiently frequent to avoid line drop 250-watt, 20/1-ratio transformers step down from the store-lighting circuit voltage, 240 volts, to the 12-volt low-tension lighting mains supplying the lamps.

Low-Voltage Multiple-Tungsten Ornamental Lighting at Belvidere, Ill.

In all about 800 lamps have been installed, representing nearly three-quarters of a mile of special street lighting in this little city of 2500 inhabitants. Each merchant pays $1 a month for his store-front illumination, averaging from four to five lamps in front of each store. The lamps burn from dusk to 11 p. m., so that the equivalent gross income from this service is 22 cents per kw-hour. Out of this charge the local lighting company expects to recoup its cost of the original installation and to furnish renewals for the lamps, which have a life of 800 hours. The service is rendered under a yearly contract agreement.

The present installation has grown from an original experimental string of lamps half a block in length near the electric company's office. The effect of these first lamps is said to have been so noticeable on the adjacent business houses that merchants not in the illuminated zone clamored for the extension of the installation, soliciting among the backward ones in their vicinity and making up the monthly rental in some cases in order to secure an unbroken line of illumination. This unique low-voltage tungsten street-lighting system was designed and installed by Mr. N. M. Argabrite, general manager of the Belvidere Public Service Operating Company, which supplies the electricity and maintenance for the installation.

250-WATT LAMPS FOR SPECIAL STREET LIGHTING.

So numerous have become the special street-lighting installations in Chicago that it seems possible to look forward to a time when one neighborhood will be connected with the adjoining one by lines of lamps, thus uniting the scattered groups in one extensive system which may be several miles in length. Possibly in time these systems may cover a considerable portion of the city, supplementing the regular street lighting.

The special street-lighting installations are paid for by merchants for the purpose of advertising the neighborhood and attracting trade. One of the latest of these neighborhood installations is on Lincoln Avenue, in the vicinity of Belmont Avenue. Here 109 aluminum-painted iron posts with fluted columns have been placed on the sidewalk, near the curb, each one supporting a 250-watt tungsten lamp inclosed in an 18-in. Alba globe. This is the first instance when incandescent lamps as large as the 250-watt size have been used for street lighting in Chicago. In the other special street-lighting installations four or five 60-watt tungsten lamps are suspended from one post. The Lincoln Avenue lamps are not spaced at regular intervals, but each one is placed in front of the place of busi-

250-Watt Sidewalk Lamps on Lincoln Avenue, Chicago.

ness of a merchant, who pays the Commonwealth Edison Company $1.50 a week under a two-year contract for the service. As may be judged by the accompanying illustration, the lamps present a handsome appearance, and the local merchants are well satisfied with their investment. The picture also shows festoons of incandescent lamps strung across the street in a local celebration.

WIRING AND ILLUMINATING CHART.

By H. D. Austin.

In the design of interior-lighting systems the engineer needs a rapid and approximately accurate means for calculating the intensity of illumination at various points, and in determining the proper sizes of wire to use.

The graphic chart shown below was designed to meet these requirements. It consists essentially of a system of hyperbolas of the form $XY = A$, where A is a constant.

Thus the well-known equation

$$I \times H^2 = \cos^3 \Theta \times C,$$

where I = the intensity of illumination normal to the plane to be illuminated,

H = distance of lamp above plane of illumination,

C = candle-power reading from photometric curve,

Θ = angle made by reading C with normal to plane illuminated,

can be written

$$I \times H^2 = A = (\cos^3 \Theta \times C),$$

and may be plotted as a hyperbola. Then by moving along this curve from one set of co-ordinates representing $I \times H^2$ to the other set of co-ordinates representing $\cos^3 \Theta \times C$ any one of the four quantities contained in the above equation can be determined graphically. This is the method used in designing the accompanying chart.

EXAMPLE.

Using a lighting unit giving the photometric curve shown in Fig. 2, it is required to determine the intensity of illumination at a point 9 ft. below and 7 ft. distant horizontally from lamp. From the angle diagram in the upper right-hand corner of the chart the angle Θ corresponding to the chosen distances is found to be 40 deg. From the photometric curve of Fig. 2 the candle-power of the unit at the angle of 40 deg. is 370 cp. Upon the left-hand side of the chart is found the length of the ordinate representing 370 cp, and along the bottom of the chart is found the length of the abscissa representing $\cos^3 40$ deg. The point upon the chart determined by these two co-ordinates

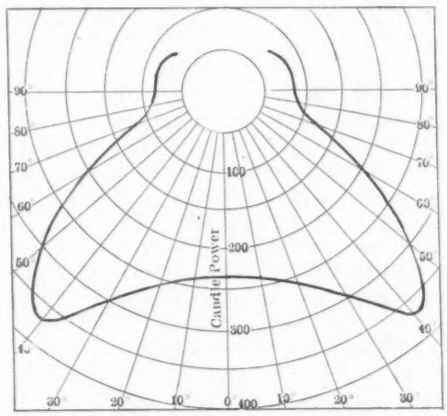


Fig. 2—Photometric Curve.

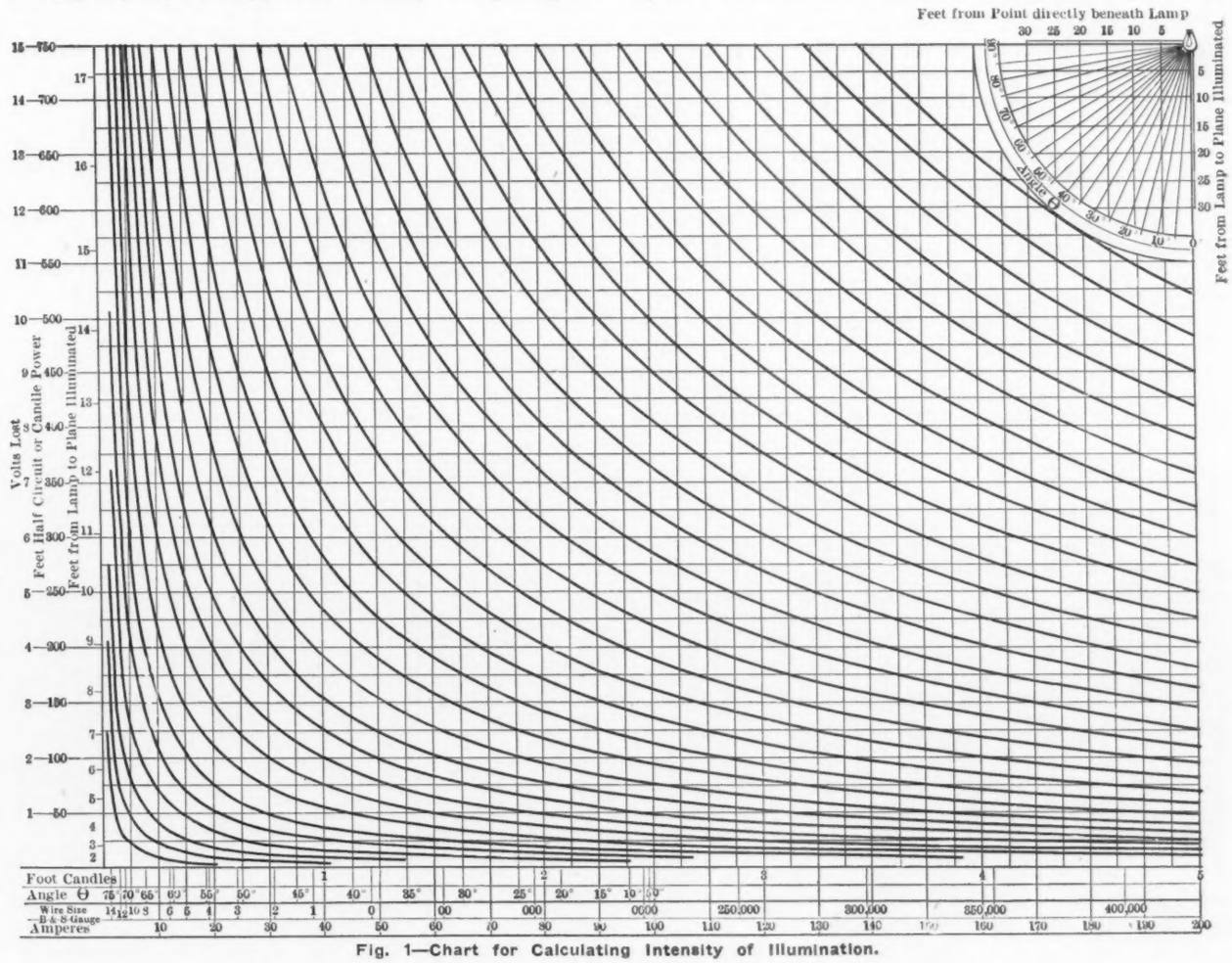

Feet from Point directly beneath Lamp
Feet from Lamp to Plane Illuminated
Volts Lost
Feet Half Circuit or Candle Power
Feet from Lamp to Plane Illuminated
Foot Candles
Angle Θ
Wire Size B. & S. Gauge
Amperes

Fig. 1—Chart for Calculating Intensity of Illumination.

falls close to a drawn hyperbola. Along this curve one should follow downward to the point of intersection with the horizontal line representing 9 ft., as shown on the scale at the side of the chart; from this point dropping vertically to the bottom of the chart 2 ft.-candles is found as the intensity required.

When the point determined by the co-ordinates representing either half of the equation falls upon or near one of the hyperbolas, the values representing the other half of the equation as taken from the curve will be sufficiently accurate for all practical purposes. When the point determined by the co-ordinates falls between two hyperbolas, rather than assume that either curve represents the exact product of co-ordinates, it is preferable to take the quantity sought from an imaginary curve which is assumed to lie between the two hyperbolas and passes through the point located.

The equation for determining the wire sizes or volts lost in an electric circuit can be solved by means of the chart in an exactly similar manner. This equation is

$$c.m.V = 21.6\,AD,$$

where $c.m.$ is the sectional area of the wire in circular mils; V is the volts lost; A is the current in amperes and D is the distance in feet. The use of the chart in the electrical circuit problem should be self-evident from the description given above.

COEFFICIENT OF DIFFUSED REFLECTION.

In a paper presented before the Philadelphia Section of the Illuminating Engineering Society on Oct. 21 Mr. F. H. Gilpin described a series of tests showing the effect of the variation of the incident angle on the coefficient of diffused reflection. In order to judge of the effect use was made of a photometric

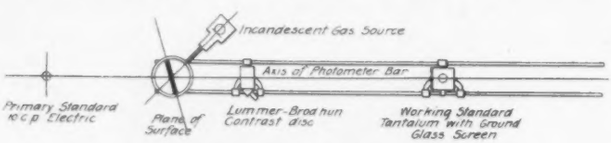

Incandescent Gas Source
Axis of Photometer Bar
Primary Standard 10 c.p. Electric
Plane of Surface
Lummer-Brodhun Contrast disc
Working Standard Tantalum with Ground Glass Screen

Fig. 1—Arrangement of Photometric Apparatus.

curve of the reflected light in the plane of the incident ray. From the curve thus obtained the ratio of the lumens reflected to the lumens incident on the plane may be calculated for each incident angle.

In the apparatus used to obtain the curves a spot of light, with sharply defined edges, was thrown on the sample surface which rotated about a central vertical line in its plane, the surface coinciding with the plane shown in Fig. 1.

The light source was an upright mantle-gas burner with a clear chimney. A seasoned mantle was used to insure a constant value of the source during a set of readings. The light source revolved and the test plane rotated, either together or separately, through 360 deg. about the same axis. Suitable pointers and a graduated scale indicated the relative position of the plane and the source and the angle between the plane and the axis of the photometer. A tantalum lamp, behind a ground-glass screen, was used as a secondary bar standard of about 2.5 candles; it was checked at frequent intervals against a standard 10-cp carbon lamp. The disk box used was a Lummer-Brodhun contrast prism. All parts of the apparatus were suitably shielded from each other and from all stray light.

Owing to the interference of the light source and the disk box, readings at certain angles could not be obtained. The corresponding points on the curves were obtained by interpolation or extrapolation, which was comparatively simple, owing to the regularity of the curves.

In calculating the percentage of light reflected from a surface two quantities were determined; first, the total amount of

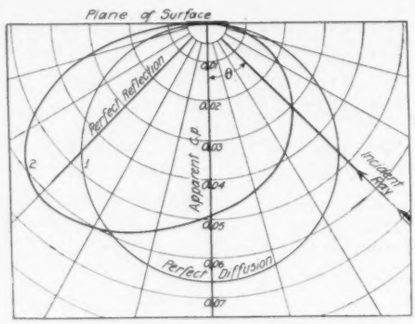


Fig. 2—Photometric Test of Paper.

light falling on it, or incident light, and, second, the total amount of light given off by the same surface, or reflected light. To obtain the former four quantities were determined: (*a*) The distance of the effective center of the light source from the axis of the surface in feet. (*b*) The area of the light spot on the surface in square feet. (*c*) The intensity of the light source in candles. (*d*) The angle between the incident ray and the normal.

The first quantity was determined once for all by revolving the light source into the line of the axis of the bar, where a direct comparison was made between it and the standard lamp. A large number of readings with the disk box at various positions were then taken. Then by equating the candle-powers observed at the various points the distance of the effective center from any fixed point was ascertained. This distance was found to be 27.63 cm, or 0.905 ft., from the axis of the surface plane.

The area (*b*) was obtained by direct measurement, as it represents a series of oblique sections and does not follow the cosine law, as would a series of similar sections of a cylinder. The maximum difference was about 4 per cent, due to the divergence of the ray of light.

The intensity of the light source (*c*) was determined by direct reading in place on the photometer bar.

Angle (*d*) was read directly from disk and pointers.

Paper No.	Kind of Paper	Finish.	Color.	Efficiency of incident angle with normal of					Mean.
				60°	45°	30°	15°	0°	
1	Pulp tint	Matt (smooth)	White	56.0	61.5	58.2	56.5	54.6	57.3
5	Pulp tint	Matt (smooth)	Light buff	46.0	47.4	45.7	43.8	42.7	45.1
6	Pulp tint	Matt (smooth)	Lt. orange yellow	42.5	44.1	43.0	42.5	42.4	42.9
7	Silk fiber	Semi-gloss	Orange yellow	38.5	36.0	33.3	31.4	30.0	33.8
4	Silk fiber	Semi-gloss	French gray	37.6	32.2	25.6	22.6	21.0	26.0
13	Silk fiber	Semi-gloss	Light pea green	27.8	25.7	21.4	18.9	18.5	22.2
15	Silk fiber	Semi-gloss	Dark pea green	23.5	18.6	14.4	11.2	9.3	15.4
9	Silk fiber	Semi-gloss	Light brown	16.8	14.6	11.7	10.9	10.3	12.9
19	Silk fiber	Semi-gloss	Light blue	15.5	13.0	10.0	9.2	8.1	11.2
10	Silk fiber	Semi-gloss	Cherry red	13.7	11.8	8.9	7.0	6.3	9.5
8	Imported stock	Fibrous	Tan	19.3	19.0	17.3	16.3	15.7	17.5
17	Imported stock	Fibrous	Light blue	13.5	13.4	12.0	11.0	10.2	12.0
18	Duplex	Rough	Light blue	12.7	12.0	10.5	9.1	8.2	10.5
11	Duplex	Rough	Cherry	6.6	6.4	6.2	6.0	5.7	6.2
3	Plain	Rough	Yellow buff	31.4	34.3	35.6	35.6	35.0	34.4
14	Plain	Rough	Light pea green	21.5	20.4	19.8	18.8	18.2	19.7
16	Plain	Rough	Dark pea green	13.4	12.7	11.3	10.7	8.9	11.6
12	Plain	Rough	Deep red	7.3	7.0	5.9	5.3	4.9	6.1
2	Varnished tile	Glossy	Cream	66.3	71.1	73.1	71.8	70.8	70.6
20	Imported	Embossed gloss	Gilt	54.0	49.3	43.7	37.7	27.0	41.7
..	White blotter	.....	.....	72.7	80.0	73.9	72.9	71.1	74.0

The computation is as follows:

$$\text{Incident lumens} = (\text{area} \times cp \times \cos\theta) \div d^2,$$

where cp = intensity of source; θ = incident angle; d = distance from effective center of light to center of spot on plane.

The angle for any incident ray having been selected, the light source and plane were clamped for that angle; both were then revolved about the fixed axis and five readings on the photometer were made at each of the 15 deg. reflected light stations. From these data the candle-power was calculated according to the inverse-square law, and a curve was plotted on polar co-ordinates for each such incident angle.

From this curve values were taken at ten prescribed equal zone angles in each quadrant, such that their average gave the mean hemispherical candle-power. The mean hemispherical candle-power multiplied by 2π gives the total lumens or the total reflected light.

In the following demonstration the coefficient of reflection is obtained for paper designated as No. 5 at an incident angle of 45 deg.

Incident Light.—The area of the lighted surface having been found by measurement and calculated to be 0.0426 sq. ft., at 45 deg. the equation for incident light is reduced to:

$$\text{Incident lumens} = \frac{0.0426 \times cp \times 0.707}{(0.905)^2} = 0.0368.$$

Candle-power of source = 11.93.

Incident light = 11.03 × 0.0368 = 0.439 lumens.

Reflected Light.—In Fig. 2 are shown two curves marked (1) and (2) taken in a horizontal plane. No. 1 is a theoretical curve for a perfect diffusing surface for light at any incident angle, but drawn to have the same mean hemispherical candle-power as No. 2. This curve, it will be noted, is a circle and its maximum candle-power will always show at 0 deg. and its average candle-power will always be one-half the maximum. No. 2 is the curve as actually obtained on paper No. 5 with a 45-deg. incident angle. It is decidedly not a circle and has none of the characteristics of No. 1. Therefore, values must be read off at the equal zone angles shown by the dotted lines and their mean thereby determined.

In order to show the difference between these characteristics the value at 0 deg. and equal-zone angles are here tabulated:

Angles for Equal Zones.	Reflected Candle-Power. No. 5 Paper.		Reflected Candle-Power. Theoretical Curve.	
	Left Side.	Right Side.	Left Side.	Right Side.
87°–8′	0.007	0.002	0.0330	0.0330
81°–22	0.020	0.006	0.0990	0.0990
75°–31	0.031	0.011	0.1650	0.1650
69°–31	0.041	0.015	0.2313	0.2313
63°–15	0.049	0.019	0.2975	0.2975
56°–38	0.056	0.023	0.3637	0.3637
49°–28	0.060	0.028	0.4297	0.4297
41°–25	0.062	0.033	0.4958	0.4958
31°–47	0.061	0.037	0.5620	0.5620
18°–12	0.056	0.043	0.6280	0.6280
	0.444	0.217	3.3050	3.3050
	0.217		3.305	
	20)0.661		20)6.61	
	0.03305	=M. H. S. C. P.	0.03305	
0°	0.0492		0.0661	

From this table there is obtained 0.03305 × 6.28 = 0.2075 lumens reflected.

$$\text{Efficiency} = (0.2075 \div 0.439 \times 100 = 47.4 \text{ per cent.}$$

In the table on the preceding page are given the results obtained from twenty samples of standard wall covering and a white blotter.

Apparently for a matt surface the greatest efficiency is obtained at 45 deg. angle of incidence, while for other types of surfaces the angle of maximum efficiency varies—as a rule, increasing with the angle. For two light colors, but different surfaces, there is quite a different efficiency, as in 10, 7 and 18; 13 and 14; 15 and 16; and 11 and 12.

Taking the above as a basis, the author said that the general effect on illumination with various wall coverings, assuming the same colors, could be stated as follows:

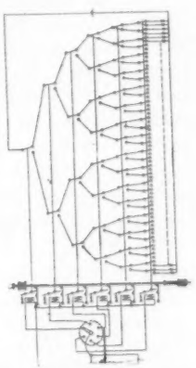
For high, narrow rooms, for indirect lighting or where the lamps are placed near the walls, a glossy paper will give the best results, while for wide, flat rooms or centrally located lamps the difference between the rough and the smooth papers would be practically negligible.

RECENT TELEPHONE PATENTS.

IMPROVED SYSTEM OF SELECTION.

With automatic systems it is necessary to select at will any one of a large number of contacts. It is, of course, impracticable to make all selections with a single series of impulses; although this method is used where all numbers are relatively low, the delay would be unbearable for high numbers. Usually the selection is made in several processes, one for each digit. This, however, requires the switch arms of each switching limit to be capable of considerable travel and to have several different stable positions.

In a system patented by Mr. E. Blos, of Germany, the selection is distributed into several different parts and the normal positions of each are reduced to two, an upper and a lower. In



Blos Transmitter for Teleselectors.

the cut the circles represent contacts. The vertical lines represent operating rods, while the lines crossing them represent switch blades. As at present shown it will be noted that all switch blades are up, and the circuit leads to the uppermost contact. It will be seen that the left-hand bar divides the contacts into halves. The next series selects by quarters; the next reduces groups to eighths, while the right-hand switches select odds and evens. The switch rods are actuated by magnets and are also interconnected with a contact wheel. The circuits are so arranged that two series of three impulses, each in proper order, will affect the selection of any number. This is accomplished through two different impulse circuits, impulse over one of which drives the contact wheel, but not the switch rods, and impulses over the other drive both. Thus, three driving steps followed by three operating steps would leave the left-hand three rows of switches up and the right-hand three down, selecting No. 18.

REPEATER.

To control the action of a telephone repeater Mr. C. Adams-Randall, of New York City, has introduced control relays. One of these is in each incoming circuit and, responding to the incoming voice currents, must operate to close the re-transmission circuit in the forward direction only, leaving it open toward the line from which currents are being received.

PARTY-LINE KEY INDICATOR.

Where party lines are used it has been found essential for good service to provide some indicator associated with the ringing key of cord circuits in order that re-rings may safely be made without bothering the calling party to repeat the code or designation of the desired station. Such indicators have taken the form of a manually operated pointer swinging over a dial where code ringing is used.. In such cases the setting of

the indicator is a special operation. Where selective ringing is used with a special key for each station it is easy to provide a mechanical indicator which shall be set incidentally to the depression of the key.

As an improvement upon such a mechanical indicator Mr. C. C. Bradbury, of Chicago, uses electric lamp indicators. For each calling cord there is provided as many supervisory lamps as there are units in the selective ringing key. That particular lamp is switched in by auxiliary contacts which correspond to the particular selective key last depressed. All other lamps are out of circuit. The patent for this indicating system has been assigned to the Kellogg Switchboard & Supply Company.

PARTY-LINE DEVICES.

A busy signal for step-by-step party-line systems has been patented by Mr. J. H. Blythe, of Denver. Each station has a properly marked target which is displayed whenever the local stepping mechanism is off normal. This is accomplished by a cam attached to the display plate, which seats itself in a notch when the apparatus is at normal, thereby withdrawing the busy notice.

In the apparatus patented by Messrs. W. C. Fisk and H. L. White, of Orofino, Idaho, any non-wanted station coming in on a line gives a characteristic and identifying signal upon the line. To this end the hook level is made to drive a wheel, which produces a series of coded buzzes. The wheel carries contact plates arranged to give the proper code and also a series of teeth to interrupt periodically the signal supply current. A locking device is provided to hold the hook switch up for a period sufficiently long to suffice for the sending out of the signals, so that the latter cannot be tampered with. The latch is released when the signal wheel has made a sufficient movement.

RECEIVER HOLDER.

A receiver holder bent up out of metal strips forms the subject of a patent granted to Mr. J. F. Hines, of Pittsburgh. This is adapted to clamp upon a desk stand of standard type. A chain attached to the device and provided with a hook at its free end serves to hold the switch-hook lever down if caught over it.

Letter to the Editor.

"Wattless" or What?

To the Editor of Electrical World:

Sir:—In the Digest of Current Electrical Literature, in the issue of Nov. 17, 1910, on page 1191, I notice a reference to the attempts made recently in France (as indicated by the contributions made by various writers to a discussion in the columns of *L'Industrie Electrique*) to find a suitable adjective to replace the objectionable word "dewatté" (unwatted), which is the French equivalent of the English adjective "wattless."

Since "wattless" is a shade or two worse than "unwatted" it is plain that the need of reform is, to say the least, as much "long felt" in the English as in the French language. Nobody ever liked these words. The French have, seemingly, decided "to do something about it." Their efforts acquire what they would call "actualité," i. e., become a matter of immediate interest for the English-speaking world, as soon as reference is made (as is done by M. Boucherot in his letter to *L'Industrie Electrique*, published Oct. 25, 1910) to the international bearing of their deliberations over the matter.

It certainly seems desirable that the "substitute," whatever it may be, which is adopted for "unwatted" ("dewatté) should be, as much as possible, homogeneous in etymology or derivation with the term replacing "wattless," the word which we all would like banished from the English language. The world recognizes the ability of the French to think and to write clearly. Nobody doubts that they will soon find, now that they have decided to do it, a substitute for "unwatted" which will maintain the reputation of the French language for clearness and precision. Unfortunately, they are not likely to give as much weight or pay as much attention as they should to a point which, I consider, is of great importance, namely, the "translatability" and "exportability" of the term selected. This has already happened many times. One could cite dozens of words like "entrefer" (air-gap), "sur-voltage," "sous-voltage," "sur-volteur," "sous-volteur" ("boosting" and "boosters" for raising or for lowering the e.m.f) which are simply matchless in their aptness and their appositeness, but which are untranslatable otherwise than by circumlocution or by using phrases instead of words to convey the whole of their meanings. If these and other expressions had been formulated partly with reference to their "translatability"—and "exportability"—it is possible that greater uniformity would have been secured, without material harm to either language.

We recognize the advantages of standardization and interchangeability in the large manufacturing industries of which ours is a most striking example. The International Electrotechnical Commission is one of the evidences of the desirability of standardizing our technical language, or, in other words, of making technical language more interchangeable and more international, and, consequently, more easy to import or to export.

I find an interesting example of lack of translatability in some of the substitutes already proposed. The terms "puissance dépensée" (power expended) and "puissance compensée" (compensated power) have been proposed for expressing, respectively, "watted" power and "wattless" power. This suggestion is really excellent—for "domestic purposes" or for "home" consumption. The moment, however, that we "look at" the same ideas through another language we see that they "change color" and are far from being as effective. We know that the symmetry of ending of the two words makes them more impressive, just as the symmetry of ending of "offensive" and "defensive" heightens the contrast between their meanings. The symmetry and the appositeness of "dépensée" and "compensée" are lost, substantially, when these words are translated into other European languages. These words are not suitable for "exportation."

M. Boucherot himself has used, provisionally, or, as he says, "while waiting for something better," the expression "puissance magnétisante" (magnetizing power). It is a satisfactory term, for which the expression "magnetizing current" has already paved the way in all countries and has established a precedent. It is suitable for "export," therefore.

The suggestion of the adjective "potential" to be used in the sense of "wattless" does not meet with favor. M. Boucherot and M. Brylinski have given very convincing reasons why this term would not be suitable and why it would be objectionable. Aside from the technical reasons which they have advanced there is the question of "exportability." It is very doubtful if the term would be accepted elsewhere, especially in America and in England, where the word "potential" is already overloaded and overworked.

The best suggestion thus far made is that of M. Brylinski, who proposes the adjective "réactif." This word has the advantage of denoting or implying the "reaction" (electrodynamic) attending the phenomenon in question without suggesting any hypothesis or postulate regarding its nature, leaving us free to decide for ourselves, or let others do it for us, as to whether the energy is potential or kinetic, or partly, or successively, both. The term is more "descriptive" than the others. It can also be translated and "exported."

In America we are prepared to go a step nearer to the actual phenomenon. Everybody here would understand what was meant if, instead of writing "wattless" power, we were to write "reactance-power." I believe that the term "reactance-current" has already been used in this country to some extent. We use the terms "reactance-component" and "resistance-component." Why could we not, "by symmetry," say also "resist-

ance-power," "reactance-power" and also "resistance-current" (that current which produces ohmic "drop" and dissipates energy by "Joulean" loss) and "reactance-current" (the component of the resistance-current which is in quadrature therewith and which is a factor of energy that is undergoing a process of displacement or transfer and not of dissipation)?

The hyphen in a compound word like "reactance-power" enables an English substantive to answer, very admirably, the purpose of an adjective. Hence we could get along without any adjective to express the idea we intend to convey when using the term "wattless." The hyphen has the same property in other European languages, notably in the Dutch and Scandinavian languages. The German language is even more accommodating in this case, because the two components of the word can be joined together directly without the hyphen. Tabulating the possibilities for some of these languages, we have:

In English	Reactance-current	Reactance-power
In German	Reaktanzstrom	Reaktanzkraft
In Dutch	Reactance-stroom	Reactance-kracht
In Swedish	Reaktans-ström	Reaktans-kraft

The French equivalents would be "courant de réactance" and "puissance de réactance." It is to avoid the preposition "de" as a connecting link—which makes the expressions less simple and wieldy—that it is desired to find an adjective. The participial adjective "réagissante" would be the logical one; and one could say "courant réagissant" and "puissance réagissante" to convey substantially the same meaning as is conveyed by the English, German, Dutch and Swedish corresponding expressions just given. The expressions "puissance réactante" and "courant réactant" would be shorter and more "descriptive"; but, unfortunately, it is very difficult in France to improvise new words without the knowledge and consent of the French Academy, which has always been noted for its extreme conservatism and its unwillingness to depart from traditional rules. The form is not "regular"; but the same thing could be said of many other words derived from various dialects, from the "argot" ("slum" language) or from the "langue verte" ("slang" language), which have, nevertheless, found their way eventually into the vocabulary sanctioned by the Forty Immortals. They were words born either of necessity or of fortuity, which made a "hit" and became so popular that even the Academy could not help recognizing them. The adjective "réactant(e)" would certainly be useful enough to be worthy of further consideration. The expressions "puissance de réactance" and "puissance réactive" would, in any case, answer the purpose pretty well. Whatever expression may be found suitable for the French language will probably be adaptable more or less readily and easily to the other "Latin" languages, because the problem of "exportation" from the French into any of these languages is usually a simple one. The difficulty comes, generally, in "synchronizing" with the other European languages.

The above is a suggested solution of a small problem in international terminology. It may not be the best, however. Let us hope that all who can contribute ideas will do so without delay.

New York. C. O. MAILLOUX.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Three-Phase Commutator Shunt Motor.—L. DREYFUS AND F. HILLEBRAND.—A continuation of their paper, illustrated by diagrams, on the theory of the three-phase commutator shunt motor. In the first instalment the authors showed that a three-phase induction motor with short-circuited slip-rings and a three-phase commutator shunt motor with short-circuited brushes are not equivalent. They differ with respect to the unequal action of the rotary stray field and with respect to the action of the currents in the coils short-circuited by the brushes in the commutator motor. In both respects the commutator motor was originally inferior. But in recent years it has become possible to overcome the bad effect of the rotor stray field by suitable connections and to overcome the commutation troubles due to the currents in the coils short-circuited by the brushes. Recent progress has been due chiefly to the use of an e.m.f. impressed on the commutator for phase compensation and speed regulation. The different methods employed differ only in the way in which this impressed e.m.f. is produced and regulated. The first method employed was to use an auxiliary regulating transformer with its primary connected to the network in parallel with the stator and with the secondary acting on the commutator. The theory of this method is given, and it is shown that it permits the regulation of speed without losses and gives an excellent power-factor. The next step of the evolution was to avoid the use of a special regulating transformer and to arrange the stator itself so as to act as a transformer. For this purpose the stator is provided not only with the normal three-phase primary winding, but with a similar winding uniformly distributed over the main winding and arranged in such a way that connections may be made at different points. By changing the connections the speed can be regulated at will. For phase compensation, however, another voltage is required and it is necessary either to provide a small auxiliary winding in the stator or to use a special compensating transformer. The latter case is first considered. Since this transformer needs to be of only a small size it is inexpensive; nevertheless it represents a certain complication. The arrangement is shown in Fig. 1. Every rotor phase is connected in series not only with the auxiliary winding on the stator, but with the secondary of a small transformer, the primaries of which are connected to the

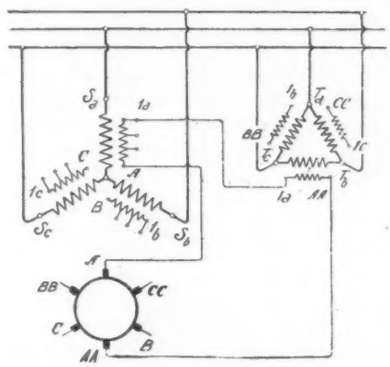


Fig. 1—Connections for a Three-Phase Commutator Shunt Motor.

network. The vector diagram for this arrangement is given and the fundamental formulas are derived. The paper is to be concluded.—*Elek. u. Masch.* (Vienna), Oct. 23 and 30.

Voltage Regulation of Compound-Wound Rotary Converters.—JENS BACHE-WIIG.—The author first discusses the combined effect of the ohmic resistance and reactance and armature reaction in a rotary converter, and shows that an approximation of their combined effects is all that is needed for practical results. The proper way to operate a compound-wound rotary converter to obtain a flat or slightly rising voltage characteristic is to adjust the shunt-field rheostat so that a lagging current is produced at no-load and to adjust the series-field turns so that sufficient series ampere-turns are produced as the load comes on to make the sum of these ampere-turns and the constant shunt-field ampere-turns produce unity power-factor at the average load. The field may be adjusted so that unity

power-factor will occur at half-load or full-load or at any other desired point on the load curve. For normal operating conditions and with the fields properly adjusted the power-factor will be nearly unity over a considerable range of load, which, of course, is desirable from an operating point of view. In order to predetermine the voltage characteristic of a compound-wound rotary converter, the total amount of reactance and resistance in the converter circuit must be known. Furthermore, the ratio of the series-field ampere-turns to the armature ampere-turns should be known. With this information the voltages and power-factors of a converter for a certain setting of the field rheostat can be closely approximated. This is illustrated by a numerical example. A number of diagrams are given showing power-factor and voltage curves of rotary converters under different conditions. They emphasize the effect of an increase of reactance. A total reactance of 15 per cent might be said to be the maximum required in the converter circuit in order to obtain an approximately flat voltage characteristic. Assuming a reactance of 5 per cent in the converter itself, it thus requires approximately 10 per cent additional reactance in the transformers and choke coils to fulfil this requirement. This is the reason that at least one of the large manufacturers of rotary converters in this country has established the standard practice of allowing for 10 per cent reactance in the transformers, thereby saving whenever possible the extra expense and space required for installing special choke coils.—*Elec. Journal*, November.

Leakage Coefficient of Induction Motors.—R. E. Hellmund.—The first part of a mathematical paper illustrated by diagrams. The author gives a summary of formulas by means of which the different parts of the leakage coefficient of induction motors can be calculated with sufficient accuracy for practice. The formulas are not empirical, but are the result of theoretical considerations. They are simplified, however, for practical use.—*Elek. Zeit.*, Nov. 3.

Compounding Alternators.—P. Noel.—An article in which the author first briefly outlines the theoretical problem of compounding alternators and then describes, with the aid of diagrams, the following compounding methods; Ganz & Company, Heyland, General Electric Company, Alexanderson, Hutin and Leblanc.—*L'Industrie Elec.*, Oct. 25.

Armature Cores.—A note on a recent British patent (824, Oct. 27, 1910) of Crompton & Company, J. C. Macfarlane and H. Burge. To assist cooling the radiating surface of the armature is increased by using core-disks of two different diameters, one slightly greater than the other. By threading these disks on alternately the larger ones give radiating surfaces at the sides as well as at the edges.—Lond. *Elec. Eng'ing*, Nov. 3.

Lamps and Lighting.

Tungsten Filament.—A note on two recent British patents (2983 and 3610, Oct. 27, 1910) of the Westinghouse Metallfaden-Glühlampen-fabrik (Vienna). The first specification describes a method of decarbonizing tungsten filaments, consisting in heating a large number together in a vacuum furnace to a very high temperature. An electric resistance furnace for this purpose is described. It is stated that with a good vacuum and a temperature of about 1200 deg. C. the carbon content can be reduced to 0.04 per cent. The second specification claims the process of adding a quantity of pure powdered tungsten (from 40 per cent to 50 per cent) to a paste of tungsten dioxide and binding material before squirting. Strong filaments can be produced from such a mixture without raising the temperature above 1000 deg. C. during the reduction of the dioxide.—Lond. *Elec. Eng'ing*, Nov. 3.

Phosphorescent Lamp.—A note on a recent British patent (4098, Oct. 27, 1910) of E. Urbain, A. Feige and C. Scal (Paris) for a high-efficiency lamp consisting of a Geissler tube containing phosphorescent sulphides painted on the inside surface of the tube or fixed on a support. The tube may contain a rarefied gas, helium being suitable. The sulphide is excited by the action in the tube and emits a white light.—Lond. *Elec. Eng'ing*, Nov. 3.

Mercury-Vapor Lamp.—W. Matthies.—An account of experiments on ionization and luminescence in the aureola of the mercury-vapor lamp. Ionization as well as luminescence has a maximum for a certain pressure, but the pressure is not the same for the maximum of ionization and for the maximum of luminescence. There seems to be more than a mere parallelism between light emission and ionization in the luminescence of the aureola of the mercury-vapor lamp.—*Phys. Zeit.*, Nov. 1.

Metallic-Filament Lamp.—H. von Löti.—An English translation of his German paper on the development of the "1-watt" metallic-filament lamp in the last two years.—Lond. *Electrician*, Nov. 4.

Wires, Wiring and Conduits.

Impregnated Poles.—An account of a long discussion at a recent International Telephone Conference in Paris. Petritsch raised the question whether the process of Boucherie, which makes use of sulphate of copper, is a suitable and reasonable means of preservation. It was used almost exclusively for telegraph poles in nearly all the central European states toward the end of the last century, but it has since been entirely abandoned by several administrations. Posts thus prepared have manifested in certain sections and localities very troublesome drawbacks; in other cases the posts deteriorated as rapidly as if they had never been protected in any way. Since the destruction of the wood is due to vegetable mold and particularly to certain kinds of fungus, methods of impregnation which are antiseptic and destructive to fungus have been taken up. Sulphate of copper, as compared with other impregnations, such as creosote, mercuric chloride and even chloride of zinc, gives the weakest antiseptic effect. But protective action does not seem to be in the same proportion as antiseptic properties. In fact, sulphate of copper yields a better result than its antiseptic action would indicate. Collette estimates the cost of an improved Boucherie process at 7 francs 50 centimes ($1.50) per cubic meter of wood treated. For this sum more than 60 kg (132 lb.) of creosote could be bought—that is, sufficient to impregnate the same quantity of wood by the Ruping process. The latter, therefore, should supersede the copper-sulphate process even where the conditions are most favorable to it. Massin's report clearly established that where the conditions were unfavorable no one would think of using the copper-sulphate method. When it is necessary to replace the posts every two or three years it is certainly necessary to use additional or other measures. To take all the precautions recommended by him would cost a sum in excess of the result obtained and it would cost as much to treat the base of the post as to creosote the entire pole. In his "Recent Tests of Creosoted Wood Poles" Henley says that under the British Post Office, where creosoted poles are almost exclusively used, not more than 50,000 of these posts are required annually for maintenance. This is amply sufficient proof of the great economy of such poles, especially with the process of Ruping, Rutgers, etc. Mycological investigation shows that 0.5 kg (1.1 lb.) of creosote gives nearly the same antiseptic effect as 1 kg of copper sulphate, costing 100 times as much. The newer processes facilitate penetration of the creosote almost to the heart of the wood with the use of a much smaller quantity than formerly. The problem now relates to the extent to which the absorption of creosote can be reduced without injury to the life of the posts. Henley has shown in the case of sections of creosoted wood which, after remaining in the soil, had been placed at the top and in the middle of the post, that only one-third of the original quantity injected had been found at the foot and one-seventh at the top and middle. The Rutgers method, used by the Austrian administration, seems to be an improvement on the Ruping process. It is possible to affirm, in view of the results obtained, that these two processes turn out posts much superior to those impregnated with sulphate of copper, especially where fungi and other destructive elements exist. The greatest drawback is that only the common pine wood can in practice be creosoted. In certain regions and even in some countries it is impossible or very expensive to procure pine

poles. Efforts are, however, being made to overcome the difficulty of treating other woods, and in Hungary considerable success has been achieved. This leads to a demand for competitors. The older Kyan method, by which the wood is immersed in a weak solution of mercuric chloride, offers a promising competitor to systems using creosote. In the discussion which followed Collette stated that an alleged average life of fifteen years for posts prepared with sulphate of copper in Holland by an improved method is too low. As to chloride of zinc, creosote and sublimate processes, the Holland administration has not had sufficient experience to compare the results with those obtained with the copper sulphate method, the value of which, as found elsewhere, may be placed between that of the creosote and that of the sublimate process. The copper method requires the wood to be treated within a few days of being felled and presents difficulties with posts more than 16 ft. long. This has led to the employment of kyanization. Creosote gives excellent results as regards arresting decay, but its emanations attack the clothes and skin of the workmen. This can only be partly met by storing the poles after treatment for a year before use. From the working point of view he is not, therefore, a partisan of creosote. Kuhlmann said that in Germany preference is given to poles creosoted under the Ruping method, the results of which have hitherto been satisfactory. Ritter said that footings of concrete are an excellent means of preservation, because it is especially at the surface of the soil that the post perishes. Statistics show a life of 15.6 years for kyanized poles. Petritsch said that other insects, such as ants, attack the wood, but he stated that creosoting offers sufficient protection. As to cement footings there has not been sufficient experience to estimate the prolongation of life which results. According to German statistics posts have the following durabilities, stated in years: Creosoted, 22.2; kyanized, 15.5; sulphated, 15.5; chloride of zinc, 12.1. These results do not apply, however, to regions or conditions where the climate or soil is different. Henley said that in England kyanization is not employed because well water might be poisoned by the bichloride of mercury. Further, the salt is very soluble and may be washed out of the posts by rain. The price of creosoting in England is unimportant, and it is preferable for the creosote to be in excess. Ritter placed entire faith in the accuracy of the German statistics. Cemented footings double the durability of the poles. The men handling the creosoted posts receive higher wages, which must be taken into account. Haltenberger said that thirty years' experience has shown the insufficiency of sulphate, and in Hungary creosoting has been adopted. The process at first was complete injection, then the more economical methods of Ruping and Rutgers were studied. They employ perforating machines to make radial punctures in the base of the post and force a greater quantity of creosote into the base, as it is most liable to attack. This method requires 90 kg (198 lb.) per cubic meter, of which 50 per cent penetrates the base and 50 per cent the staff. According to Henley the post after erection ultimately retains in the upper portion only one-seventh of the weight injected, but under the Hungarian process, after several years' exposure, the exact quantity injected into the base by the Ruping process, namely, 3 kg (6.6 lb.), is found there, but after a further period of several years this is reduced to 1 kg (2.2 lb.). This corresponds to experiments made in France. The improved process, as compared with that of Ruping or Rutgers, could be applied to all resinous woods, which is a considerable economical advantage. Massin remarked that the drawbacks of creosoting are aggravated in hot countries.—Lond. *Electrician*, Oct. 28.

Light Metals for Conductors.—W. VON MOELLENDORFF.—The author compares different metals which might be used for overhead transmission lines, especially steel, iron, bronze, hard copper, aluminum and "spree aluminum" (the latter being a special alloy made by the Allgem. Elek. Ges.). He compares them especially with respect to their mechanical strength (sag at different spans, etc.) and cost. His conclusions are favorable to aluminum. For very wide spans he recommends the alloy "spree aluminum." The latter is mechanically equivalent to hard copper and is cheaper as long as 1 kg costs less than 1.5 times the cost of 1 kg of pig copper.—*Elek. Zeit.*, Nov. 3.

Electrophysics and Magnetism.

Electric Charge of Ions or Corpuscles.—F. EHRENHAFT.—A paper in which the author gives an account of further experiments with his improved method on the determination of the electric charge carried by an ion. The method is somewhat similar to that used by Millikan, but it would seem that the particles used by Ehrenhaft are much smaller. He does not get concordant results and he concludes that there are in nature electric quantities which are smaller than the so-called ionic charge. The paper elicited a very long discussion, in which Planck emphasized that the experiments presupposed the exactness of Stokes' formula.—*Phys. Zeit.*, Nov. 1.

Radium B.—A paper by S. Russ and W. Makower deals with the deflection by an electrostatic field of radium B on the recoil from radium A. It is shown that radium B is positively charged when it recoils from radium A and that the "recoil-atoms" can be deflected by an electric field. Another paper by W. Makower and E. J. Evans deals with experiments on the deflection suffered by the radium B when it passes through a strong magnetic field. From their experiments they find that the value for the atomic weight of radium B is 194. Considering the difficulty of the experiments, this number is in good agreement with the theoretical value of 214.—*Phil. Mag.*, November.

Speed of Röntgen Rays.—E. MARX.—A second paper of the author describing new experiments made by him on the speed of Röntgen rays, which is found to be practically the same as that of light. The author does not believe that Röntgen rays are of a corpuscular nature.—*Phys. Zeit.*, Nov. 1.

Magnetic Alloys from Non-Magnetic Metals.—A. D. ROSS.—A long paper presented before the British Institute of Metals and giving the results of experiments with the following ternary alloys: copper-manganese aluminum, copper-manganese-tin, copper-manganese-antimony, copper-manganese-bismuth, and with the following binary alloys: copper-manganese, copper-aluminum, manganese-antimony, manganese-boron.—Lond. *Eng'ing*, Nov. 4.

Electrochemistry and Batteries.

Demonstration of Faraday's Law.—R. MÜLLER-ERI.—A description of a coulometer for demonstration purposes. The object is to avoid the waste of time in weighing the cathode deposit. The apparatus is shown in Fig. 2. The anode is contained in the tube on the right. The cathode, in the tube on the left, consists of a platinum wire connected to copper wires at the top and the bottom of the tube. Instead of weighing the cathode, the decrease of its resistance due to the deposit is measured. This is much simpler and quicker than weighing and each experiment lasts only a few minutes.—*Phys. Zeit.*, Nov. 1.

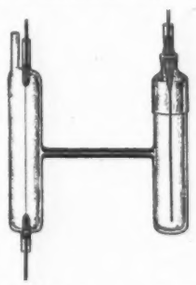


Fig. 2—Stephan's Coulometer.

Generation, Transmission and Distribution.

High-Tension Transmission in Europe.—An article on the first 110,000-volt transmission system of Europe. The Lauchhammer Steel Company of Germany has four works in different districts which have had their own generating plants. Since

extensive lignite deposits have been discovered on one of these works a steam plant will be erected and all the works of the company will be connected together by a transmission system. This will also supply energy to a central station in Gröba which serves the agricultural and industrial districts in the neighborhood. For the present three 5500-volt turbo-alternators, each of 5000 kw, will be erected. The voltage will be raised from 5500 to 110,000 by four three-phase oil transformers, each of 6800 kva.—*Elek. Zeit.*, Nov. 3.

Swedish Water-Power Plant.—H. Cheret.—The conclusion of his long illustrated article on the Yngeredsfors power plant and 40,000-volt transmission line to Varberg and Molndal-Gothenburg, in Sweden. In the present instalment the author deals with the transmission line and substations.—Lond. *Electrician*, Nov. 4.

Charging Blast Furnaces.—H. Hermanns.—A fully illustrated article on the use of an electrically operated suspended conveyor system for charging blast furnaces.—*Elek. u. Masch.* (Vienna), Oct. 30.

Traction.

Glasgow.—An abstract of last year's financial account of the municipal tramway system of Glasgow. The number of passengers has increased from 221,744,569 to 222,730,571, the revenue has grown from $4,463,755 to $4,483,600, and the working expenses have decreased from $2,528,090 to $2,514,555 in spite of an increase in the number of car-miles from 20,802,797 to 20,974,016. On the car-mile basis, however, the total revenue works out as 20.52 cents per car-mile, compared with 20.60 cents formerly. A figure which is not often stated and which is, therefore, of interest is the traffic revenue per car-hour. On the Glasgow tramways this averaged 159.6 cents, as against 158.8 cents a year ago. The specific energy consumption was 1.28 kw-hours per car-mile, compared with 1.25 kw-hours per car-mile in 1908-9. From the generating station 28,618,128 kw-hours were supplied and the cost per kw-hour sent to the substations was 0.748 cent without capital charges and 2.416 cents including depreciation, interest and sinking fund.—Lond. *Electrician*, Nov. 4.

Cleaning of Tramway Rails.—A. Schörling.—A report made to the International Tramway and Light Association. After pointing out the great importance of properly cleaning the rails of a tramway system, from the point of view both of the rolling stock and of the passengers, the author goes on to describe the various apparatus that are used for this purpose. In conclusion some figures relating to cost are given.—Lond. *Electrician*, Nov. 4.

Traction Motor.—An English translation of the French paper of P. Bary, recently abstracted in the Digest, on a new form of traction motor. The feature of the motor is that the windings of the main poles and those of the interpoles to some extent overlap.—Lond. *Elec. Review*, Nov. 4.

Installations, Systems and Appliances.

Circuit-Breaker Relay Systems for Power Transmission.—R. P. Jackson.—As used on transmission lines, circuit-breakers and their relays are not so much required for overload purposes as for the elimination of defective lines. The strictly overload requirements can ordinarily be met by circuit-breakers on the low-tension side of the substation transformers. On the other hand, the certain localizing of a ground or short-circuit on a transmission system without serious disturbance to the delivery of energy to otherwise unaffected apparatus is often a difficult problem. The three abnormal circuit conditions which may arise and for which relays may be arranged to serve in cutting out the damaged portion of the circuit are reversal of energy flow, a ground and loss of energy between stations, or, in other words, cases in which an appreciable portion of the energy leaving one station does not reach the receiving station. The use of relay systems for these three conditions is discussed with the aid of diagrams. It sometimes develops that simpler and more generally reliable operation can be obtained without any overload or reverse-power protection, while in some cases a simple overload relay system with definite time limit is the most satisfactory. When the generating station and line are of moderate rating it has been found practical in case of trouble simply to lower the voltage on the generating system until a short-circuit has cleared itself and then raise the voltage and resume operation. This is, of course, a somewhat crude method of operating, as is also the burning off of a ground or short-circuit, and is only applicable to systems of limited size. Another method which has given fair results is to erect two lines to each substation, but let each station draw energy from only one line at a time, the lines to be parallel only at the generating station. If with this system of operation overload relays with definite time limits are provided at the generating station and intermediate switching stations and set for progressively longer periods from the distant ends toward the generating station, only the defective portion of the line will be cut off and energy can at once be obtained at any station by closing the switches to the other live line.—*Elec. Journal*, November.

Earthing Three-Phase Networks.—At Frankfort, in Germany, one of the phases of the three-phase network has been earthed at the generating station through a water column of 2 ohms resistance, with the result that pressure surges have been greatly diminished in frequency. The danger of leakage to earth in the network is reduced by one-third, and when a fault occurs on one of the insulated lines the circuit-breakers are opened at once. Switches are required only on the insulated conductors. In the case of overhead lines the earthed conductor is carried on the top of the poles on low-pressure insulators and is protected at intervals by low-pressure lightning arresters, thus reducing the cost of installation. The results of the system are regarded as very favorable.—Lond. *Elec. Review*, Nov. 4.

Electricity in Fire Fighting.—Some notes on the use of electricity in German fire departments. Electric automobiles are being generally introduced in Hanover and Berlin to supplement horse-drawn engines. For dealing with high-pressure cables a special set of tools is provided.—Lond. *Elec. Review*, Nov. 4.

Units, Measurements and Instruments.

Audiometer and Its Use in Telephony.—C. A. Smith.—The author refers to the invention by Hughes of the induction balance and the audiometer some thirty years ago. He urges that the audiometer should now have many practical applications. It consists of two flat coils *A* and *B* (Fig. 3), about 7.5 cm in diameter and 1 cm deep, which are fixed upon a suitable baseboard in a vertical position about 25 cm apart with their planes parallel and their similar pole-faces in opposition to each other.

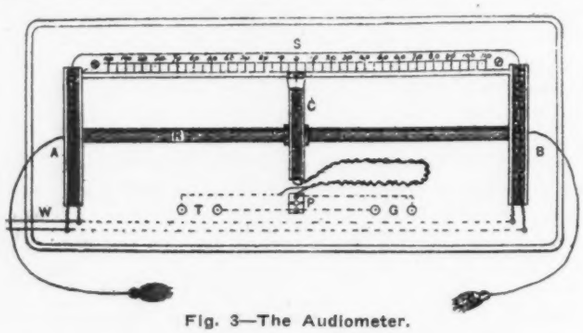


Fig. 3—The Audiometer.

These coils are wound with the same length of insulated copper wire, so as to have an equal resistance, from 60 ohms to 100 ohms, and to produce exactly equal opposing field strengths. Between these two coils a third similar one, or "search coil," *C*, wound with finer wire and about 5 cm in diameter and 7 mm deep, is made to slide to and fro along a vulcanite rod *R*. This rod is grooved the entire length longitudinally underneath to allow a pin fixed into reel *C* to slide along when either of the silk cords shown is pulled. The search coil is supplied with a vernier which slides edge to edge with the

fixed scale *S* and is connected up to two pairs of terminals *T* to *G* and plug-switch *P*. The scale is divided into 110 millimeter divisions on either side of a center zero. The two coils *A* and *B* are connected together in parallel and operate by a suitable tone vibrator or standard telephone set reserved for the purpose. Either would, of course, be placed away from the balance, so as not to be audible without the receiver belonging to the apparatus. Since the two coils *A* and *B* are so constructed as to be equal and opposite electrically, the opposing magnetic fields produced will have no effect upon the search coil when it occupies the central or nodal position, and the telephone will be mute. If, however, it be moved toward either *A* or *B* it will be "out of balance" and the telephone will sound accordingly. To test the hearing of a person it is only necessary to apply the vibrator or standard telephone set, beginning with the search coil well out of balance and gradually moving it toward the center until the sound or voice is just audible. This should be repeated on the opposite side of zero and the mean taken for each person or ear tested. Similarly a telephone company can ascertain the qualities of the operators' hearing upon their engagement and also examine the acoustic values of receivers with it. From a telephonic viewpoint the quickness of operators' hearing, as well as the sensitiveness of receivers, could be even better judged by quantitative measurements made with a vibration or thermo-galvanometer placed in the search-coil circuit by plug-switch *P*, shown in the sketch.—Lond. *Elec. Review*, Nov. 4.

Gear Testing.—An illustrated description of a new gear-testing apparatus of English make which enables accurate measurement of the efficiency of worm gearing. It is shown in Fig. 4. The gear to be tested is driven by a motor, the loss in which is accurately known, so that the brake-horse-power input of the gear is given immediately. The power given out by the gear at the slow-speed shaft is measured by a transmission dynamometer, and the ratio of the two represents the gear efficiency. Use is made of a second gear in which the wheel drives a worm which in turn operates a generator forming the load. This second gear is a special test gear, which can be arranged to give any ratio of speed. This enables a test to be made on a gear of any horse-power or speed. In addition to the power measured by the dynamometer that taken from the generator is accurately measured, and the efficiency of the test gear being known an additional means of arriving at an efficiency of the gear to be tested is provided. With two similar gears a purely electrical or Hopkinson test is made, and this is, of course, a very accurate method of testing. Any required load can be instantly obtained from no-load to a considerable overload.—Supplement to Lond. *Electrician*, Oct. 28.

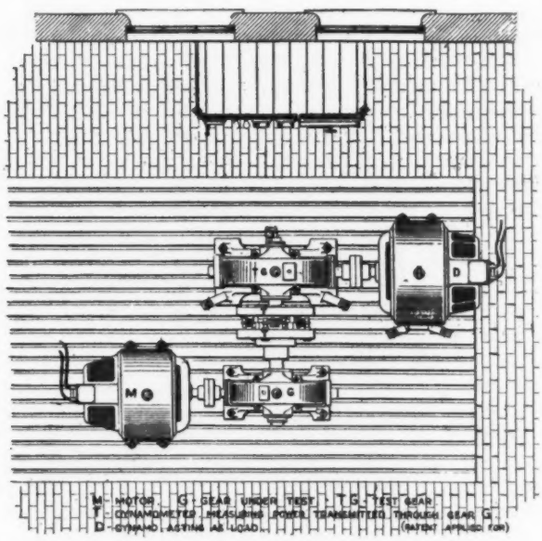

M
G
D
M - MOTOR G - GEAR UNDER TEST TG - TEST GEAR
T - DYNAMOMETER MEASURING POWER TRANSMITTED THROUGH GEAR G.
D - DYNAMO ACTING AS LOAD.
(PATENT APPLIED FOR)

Fig. 4—Gear-Testing Apparatus.

Telegraphy, Telephony and Signals.

Time Signals by Wireless Telegraphy.—In 1904 and 1905 Albrecht provided chronometers with a recording mechanism for their control at a distance by means of radiotelegraphic signals. It is evident that such signals would be very valuable, especially for longitude determinations out at sea. The Eiffel Tower radiotelegraphic station has been partly fitted out for that object. Registering mechanisms are apt to complicate chronometers, however. The method adopted at Paris was that of the observation of telephone coincidences suggested by Guyou in 1906 and tried between Paris and Brest. Tests as to the reliability of this method have been carried out by A. Claude, Ferrie and L. Driencourt and have been described in a communication presented to the Académie des Sciences in April, 1910. For this purpose sharp, distinct radiotelegraphic signals have to be sent out at regular intervals; these intervals should hardly differ from the intervals of the beats of the two pendulums under comparison, but not absolutely coincide with them. An electromagnetically excited pendulum was fitted with a short cross-bar of silver, the bar was fixed at a distance of about a quarter of the pendulum length from the pivot, and it just touched when at rest two elastic rings of fine silver wire. These rings formed the terminals of the relay circuit which actuated the radiotelegraphic apparatus. Ordinary Hertzian waves would, therefore, be emitted as long as the pendulum was not swinging. When the pendulum started to oscillate the one ring would be compressed and the current interrupted at the other. The emission of waves would thus stop. By means of a micrometer screw the rest (zero) position could be adjusted in such a way that only one spark was given each time the pendulum passed through the zero; a sharp signal was then given. These signals were sent from the Eiffel Tower by means of a pendulum whose length was so adjusted that in eighty-eight seconds it made one oscillation more than the two pendulums to be compared. Of the two chronometers under trial, the one was at the observatory at Paris, the other at the Montsouris Observatory. Each of the observatories was provided with a small antenna in order to make the conditions similar to those of a receiving radiotelegraphic station at a considerable distance from the transmitting station on the Eiffel Tower. The electrolytic receivers were so tuned that the operator heard, in the telephone, not only the sharp rap of the arriving signal, but also the beats of the chronometer in his station. As the two sounds are similar in acoustical character the coincidences were not difficult to observe. Each of the two stations thus determined the coincidences of its chronometer and the signals—that is, the pendulum beats on the Eiffel Tower and the difference between the two chronometers could then be ascertained. One of the chronometers was marked mean time, the other stellar time. Both before these tests were carried out and after their completion Guyou telephone tests were also made. In this way the difference "telephone signal minus radiotelegraphic signal" was determined. This difference proved always very small, 0.01 second in the worst case; it was sometimes positive and sometimes negative, and the average was ± 0.006 second. The research would thus show that very accurate comparisons of chronometers and determinations of longitude can be effected by means of the radiotelegraphic method, and this should become valuable for geodetic survey.—Lond. *Eng'ing*, Nov. 4.

Bookkeeping.—G. JOHNSON.—The conclusion of his article, illustrated by various blank forms, on bookkeeping and accounts of telephone undertakings.—Lond. *Elec. Review*, Nov. 4.

Miscellaneous.

Electrical Industries in the United States and Great Britain.—J. S. PECK.—His presidential address to the Manchester Section of the (Brit.) Inst. Elec. Eng. He summarized his chief impressions from a recent visit to the United States and compared American with English practice. What impressed him most in the United States were the enormous quantities of standard machines that are being manufactured and the great advances made in electric traction. As to high-tension trans-

mission he said that several plants are operating successfully at 110,000 volts, "and a pressure of 200,000 volts appears much nearer than did one of 100,000 volts ten years ago"; in fact, one of the best known transmission engineers in America told him that he was quite prepared to recommend 200,000 volts now and was sure it could be handled successfully. The transformer manufacturers will certainly jump at the chance of building commercial apparatus for this voltage. With pressure of this order, a generating station in the Manchester district could reach every large city in Great Britain. The higher the voltage the less the trouble experienced from lightning on transformer apparatus, but, on the other hand, the greater the trouble on the transmission line itself, due to broken insulators. This may be explained by assuming that ordinary lightning effects have a value which is independent of the line voltage, so that apparatus built for a very high line voltage is much better able to withstand lightning effects than is a machine wound for a lower voltage. On the other hand, when a lightning discharge takes place over an insulator, the higher the line voltage the greater the tendency for the arc to hang on and rupture the insulator. The general tendency on very high-voltage lines is to cut out protective apparatus for the transformers and endeavor to protect the line. Apparently the most satisfactory method yet proposed for doing this is the use of the overhead grounded wire, though lightning rods on each pole or tower, metal rings round the pin, etc., are being tried. For e.m.fs. below 40,000 volts lightning arresters are almost always used, for at these pressures the lightning discharge voltages are far higher in proportion to the line voltage than they are at pressures in the neighborhood of 100,000. The electrolytic arrester is being almost universally adopted. In turbo machinery the tendency is toward higher and higher speeds. The general practice is to build machines with poor regulation and to supply automatic regulators for maintaining constant voltage. With reference to direct-current turbo-generators much greater progress has been made in Great Britain than in America, for while large numbers of very small machines are being built in America, the large ones are few, and, in general, of lower speed than are found in England. The majority of the transformers are of the shell type, whether made for single-phase or three-phase. The core type is used when the voltage is very high in relation to the rating of the transformer. An enormous business is being done in transformers from house-to-house lighting in sizes from 0.5 kw to 100 kw. As to the manufacture of measuring instruments he was impressed by an American plant turning out 1000 alternating-current watt-hour meters per day. "The meters are beautifully made and contain various adjustments and refinements not found on European meters, yet on account of the enormous output they are able to be manufactured for much less than the same instrument could be made for in England in spite of the fact that the price of labor in the United States is more than twice as high as in England." He referred to the "keenest engineering competition" between the General Electric and Westinghouse companies. "As a result, they strive not only for the improvement of shop methods, but for advances in the electrical and mechanical design of their apparatus and for the development of new and improved types." He summarized the difference in conditions in the United States, where the electrical industries are flourishing, and England, where "manufacturers deplore the condition of the business." The United States is a new and rapidly growing country and the directors of British companies are often too conservative. There is no doubt that Great Britain is far behind both Germany and America in the extent to which technical education is adopted, especially with respect to higher technical education. The electrical manufacturer of America has never been seriously hampered by those restrictions which labor organizations attempt to impose upon British manufacturers. Municipal control of electric supply and tramways was never seriously undertaken in American cities. The policy of the municipal undertakings in Great Britain in accepting the lowest tender is in part responsible for the cut-throat prices which rule to-day. Perhaps the greatest electrical development in America has been in traction work, and while a great part of this has been in the cities, there has been an enormous development in inter-urban railway lines—a field which has been scarcely touched in Great Britain, owing to the expense of getting bills through Parliament, the jealousy of town councils and the opposition of wealthy property holders along the proposed lines. The large electrical manufacturing companies in America employ specialists in all departments of engineering, and it is generally admitted that these men know more about their particular lines of work than the consulting engineer can be expected to know. The consulting engineer tells what he wishes to accomplish and the manufacturer says how this could best be accomplished by standard apparatus, so that they can supply a better and cheaper plant than if the consulting engineer called for all manner of special apparatus. In England the practice has been for the consulting engineer to specify in great detail the particulars regarding all the work to be done by the manufacturer. In America the demand for labor is usually greater than the supply and the rate of wages at least double that in England. This condition naturally creates a great difference in the demand for labor-saving machines and is in part responsible for the enormous demand for small electric appliances. A very large market for electrical apparatus has been created in America by the utilization of water-powers. "Regardless of whether a tariff would help Great Britain or not, there is no doubt that it has greatly helped the American electrical manufacturer, for, with an enormous home market, he has pushed ahead with its development with the assurance that it was reserved for him and that no foreign competitor could take it from him. So large is this home market that its demands have filled his works with orders at remunerative prices and left little inducement for him to compete for foreign business. The tariff wall is naturally responsible for higher prices in America, but low prices and prosperity are not synonymous terms."—Lond. *Electrician*, Nov. 4.

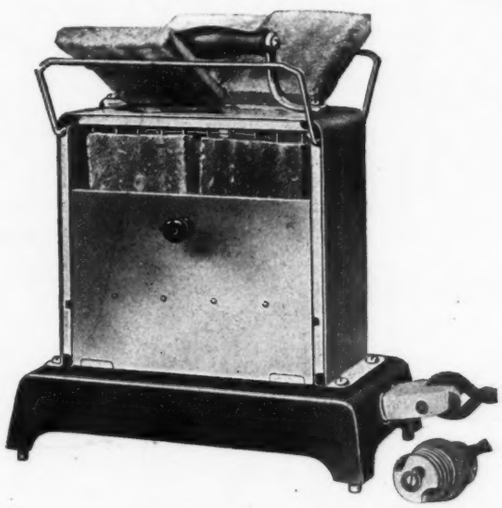
Engineering and Civilization.—Alex. Siemens.—His presidential address to the (British) Institution of Civil Engineers. "A review of the history of knowledge from the prosperous period of Greece during the fifth and fourth centuries before Christ down to the present time shows that in literature, art and philosophy we cannot boast of being greatly superior to the ancients, but as far as engineering problems are concerned we have enormously advanced, thanks to the practical application of scientific theories. Comparing generally the conditions of life then and now the difference may be summed up by claiming that our progress is due principally to the improvement of the means of communication and to the saving of manual labor by the introduction of mechanical power, which main features have caused a general lowering of the cost of 'obtainables.' Both these features characterizing modern civilization are the outcome of the work of the engineering profession and progress has by no means ceased in our time." The development of the manufacture of incandescent lamps is a striking example of the advantages of labor-saving machinery. The introduction of a labor-saving machine does not diminish opportunities for employment, but benefits the skilled workman and opens avenues for the employment of unskilled labor. By the great improvement in the means of communication engineers of all countries are put on an equal footing with respect to technical knowledge. A broad distinction should be made between contractors' work and manufactured produce. With regard to contractors' work, the consulting engineer must be the real expert, with a varied practical experience in similar work, in possession of all the necessary preliminary data for designing the complete works, and well acquainted with all the details of the method of carrying them out. The case is different with manufactured produce which is utilized in engineering works, the variety of which is constantly increasing, so that it is perfectly hopeless to expect that every engineer who requires manufactured goods to carry out his designs can be acquainted with every detail of their manufacture. Moreover, trained technical experts are nowadays intrusted with the task of di-

recting industrial operations in factories, and it is inevitable that they should know more about manufacturing methods and requirements than outsiders. The author spoke of the rôle which the Engineering Standards Committee has assumed by deciding cases arising between engineers and manufacturers with respect to specifications and tests. Every profession must have its science which teaches the sound reasoning on which its art is based, and for both science and art training is a necessary condition for success. College teaching should occupy itself principally, though not exclusively, with science, leaving the art of engineering to be developed by practical work either in the field, in the drawing office or in the workshop. If the improvement in communication has a tendency to aggravate the burden of competition and to place all nations on a footing of equality, it insures, on the other hand, the continued progress of our civilization by guarding it from the fate that befell the culture of so many ancient empires which have left only scant traces of their once flourishing state, because no adequate means existed for spreading their knowledge or for protecting it from destruction. There is the further advantage that, in conjunction with the saving of manual labor, modern facilities of communication insure leisure and thereby opportunity for cultivating the mind in other respects than merely on utilitarian lines.—Lond. *Electrician*, Nov. 4.

New Apparatus and Appliances

BREAKFAST-ROOM TOASTER.

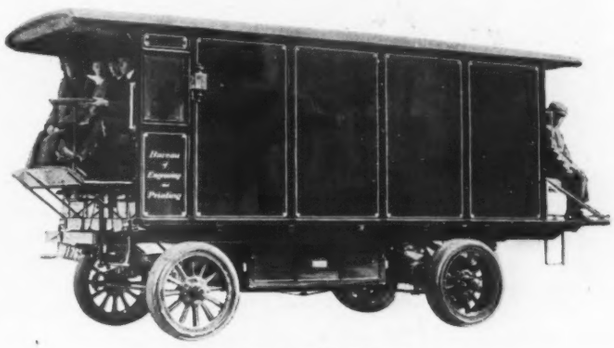
The Simplex Electric Heating Company, of Cambridge, Mass., has made an improvement to its well-known breakfast-room toaster in the shape of a rack on top of the device, which, when the toaster is not in use, may be dropped out of sight. The toast rack consists of two wire supports projecting upward at an angle of about 45 deg. from either side, coming out of the top of the toaster. These provide supporting bars to hold the toast, the other end of the toast resting on the top of the frame. The rack in no way interferes with the operation of the toaster, but places the finished product directly over the hot air rising from within the device, keeping it warm, or drying fresh bread while other toast is being made. In the Simplex toaster the bread is inclosed while toasting so that it does not curl out of shape, nor do crumbs fall on the table about the toaster. Being highly polished, the toast can be kept in its hot condition within the toaster for ten or more minutes after the circuit is opened. The device consumes 500 watts and can be obtained in boxes wrapped in holly for the holiday trade.



Breakfast-Room Toaster.

ELECTRIC "MONEY" WAGON.

An electric "money" wagon is the latest acquisition of the United States Treasury Department, Bureau of Printing and Engraving, Washington, D. C. The vehicle was built by the Studebaker Company to combine strength, ample size and safety—qualities highly necessary to meet the peculiarities of the service in which it is employed. The accompanying cut suggests the commodious interior of the body, which is closed at the front and provided at the rear with heavy doors, which when closed and bolted present as formidable an appearance as the barred door of an express car laden with a shipment of gold. Space is provided on the front seat and also on a rear seat extending the width of the vehicle for a number of armed guards, and mounted horse guards also accompany the vehicle when it makes deliveries of money to the Treasury. The wagon operates between the Bureau of Printing and Engraving building, where the paper money, stamps and bonds are printed and engraved and prepared for circulation, and the United States Treasury, and supplants the horse-drawn wagons formerly used.



Electric Money Wagon.

RELAY FOR INDUCTION REGULATORS.

The Westinghouse Electric & Manufacturing Company has just brought out an entirely new design of secondary or auxiliary relay for its induction regulators, which embodies several features that have been found desirable in this class of apparatus by the Westinghouse company. The new relay is of the dry type, while the former was oil-immersed. The non-inductive resistance that was used in the old-style relay is used with the new style, but is now built as a primary part of the relay This resistance, permanently connected across the contacts, absorbs the inductive discharge of the coils at the moment of breaking of contact and assists in the elimination of sparking.

As all the wearing parts used in the new relay are case-hardened, it is very durable. In fact, the relay has been designed as a continually operating, hard-service mechanism instead of as an instrument. The use of nickel for the relay contacts is a marked advance, as it gives all the advantages of platinum at a cost for renewals that is negligible. The result obtained from the operation of motor-operated regulators by means of this relay are stated to be very satisfactory. The wear on the contacts is so slight that the adjustment and renewal of contacts are reduced to a minimum. When necessary,

however, this adjustment or renewal can be very easily effected.

A feeder regulator will pay its cost in a short time by main-

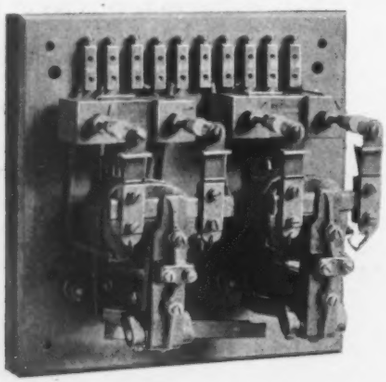


Fig. 1—Relay for Voltage Regulator.

taining the voltage at a constant point, as close voltage regulation causes a decrease of lamp renewals, an increase in the sale of energy, an increased feeder capacity and a higher econ-

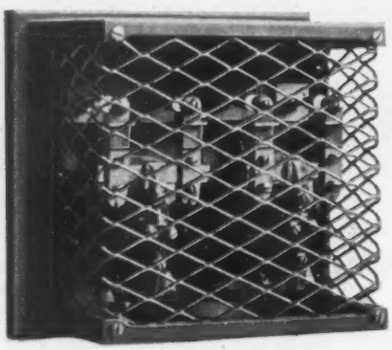


Fig. 2—Relay Inclosed in Wire Cover.

omy of operation of the system, while helping greatly in making the customers satisfied with the illumination and service.

A FLEXIBLE ELECTRIC-CRANE INSTALLATION.

An unusual electric-crane installation in which the carriage with its load may leave the movable bridge, running off onto side spurs leading into the nearby buildings, is that employed by the Simmons Manufacturing Company, Kenosha, Wis., for conveying scrap and pig iron from its storage yard to the foundry cupolas.

For this purpose a 60-ft. span Pawling & Harnischfeger crane is fitted with two I-beams forming a trolley runway on which the suspended cars can move transversely. At a point opposite the entrance to the cupola house a trestle-supported I-beam is brought out to the craneway, matching with the trolley track so that the cars can be run off to discharge their loads into the cupola house. The crane-bridge runway is several hundred feet in length, its 60-ft. span covering the entire scrap yard, so that material from any part of the yard can be picked up, loaded into the bucket and conveyed directly to the charging floor without subsequent handling.

Two cars of the suspended type are provided, as shown in Fig. 1. One is equipped with a 40-in. Electric Controller & Manufacturing Company's electromagnet for handling pig and scrap iron, and for breaking up material with a skull-cracker ball (Fig. 2), while the other car is fitted with a large dumping bucket for hauling coke, limestone, etc. The magnet carriage comprises a 5-ton hoist, and the bucket is handled by a 3-ton hoist, each controlled from the inclosed operator's cage trailing behind its respective hoist.

The trolley conductors supplying energy for the carriage travel are, of course, extended along the spur I-beam tracks. On the bridge of the crane other conductors connect to the bridge-movement motors, so that the longitudinal movement as well as the transverse motion of the load can be manipulated directly from the operator's cage while the car is on the crane bridge. In case of necessity for repairs to either car it can

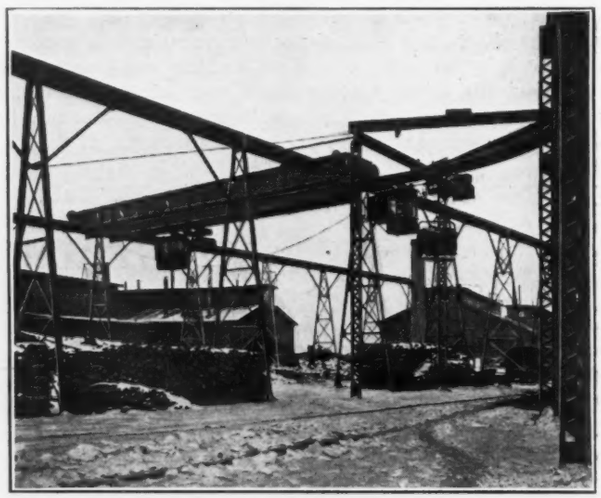


Fig. 1—Bucket Car Leaving Crane and Passing Onto Spur Runway.

be removed from service by running it off onto the spur, while the other hoist is used for either the magnet or bucket by unhooking the swivel hook at the lower block.

Since on the bridge the cars move on independent I-beam runways, 5 ft. apart, their relative positions are entirely independent as far as transverse motion is concerned. Safety stops are provided so that neither car can be accidentally run off the bridge beams unless in position opposite the spurs. The hoist cars can travel at a speed of 450 ft. per minute, approximately the same as the rate of bridge travel, and while the cars are on the bridge both motions can be combined.

The present crane installation, which requires the services of one or two operators and not more than two ground men, has

Fig. 2—Crane Carriage with Magnet on Spur Runway.

replaced the former system of charging the cupolas by narrow-gage push cars, which required twenty-five or thirty men.

ELECTRIC CULTIVATOR FOR INTENSIVE FARMING.

The electric motor application illustrated herewith is of more than passing interest, for it represents the attempt of its inventor, Mr. F. H. Kerr, 5969 Union Avenue, Chicago, to anticipate an economic change in the agriculture of this country

which will result in more intensive farming, involving the use of electrically driven machinery on comparatively small parcels of land. Mr. Kerr is a practical farmer, born and brought up on a farm and also trained in scientific soil cultivation in an agricultural college. He is convinced that there is an impending change in farming methods in the United States owing to growth of population, the taking up of all virgin arable land, the development of irrigation, the high cost and scarcity of labor and the "back-to-the-farm" movement. He points out that since the limit of farming area in this country has been reached, or nearly reached, the acreage per capita must decrease. It will be necessary to obtain a greater yield from smaller farms. Conditions in this country do not permit this being done by cheap manual labor, as in Japan, for instance, and it will be necessary to employ machinery for intensive cultivation to an extent now unknown. This machinery may be driven most conveniently and, as the number of plants increases, most cheaply by electricity. The use of horses in farming operations means widely separated rows of plants, involving a proportion of unused land that cannot be afforded with intensive farming.

Mr. Kerr believes that in time to come, as holdings of land diminish in size, farm houses or country homes will be much closer together, and that it is likely that electric distribution lines will be built between parallel roads, bare coppered steel service wires extending from this line to the houses on each side. By sliding or rolling contacts and a flexible conducting cable of suitable length electrical energy may be available for a considerable distance on each side of the service wires, thus serving an area of respectable size. However, this is a hope for the future. The present machine may be operated from any suitable source of electricity through a practicable length of conducting cord.

The inventor has already produced an electric lawn mower (*Electrical World,* July 22, 1909, page 219), and the cultivator illustrated herewith is an outgrowth of that invention, and, indeed, the machine illustrated may be used either as a lawn mower or cultivator. As shown in Fig. 1, a 1-hp alternating-current motor is mounted between a pair of tubular steel handles and over a small traction wheel. In front and journaled to the handles is a tubular shaft carried about 6 in. above the ground and in front of the traction wheel. This shaft carries spirally arranged teeth spaced 2 in. apart on the shaft and projecting about 6 in. on each side of the shaft. A chain drive and sprocket

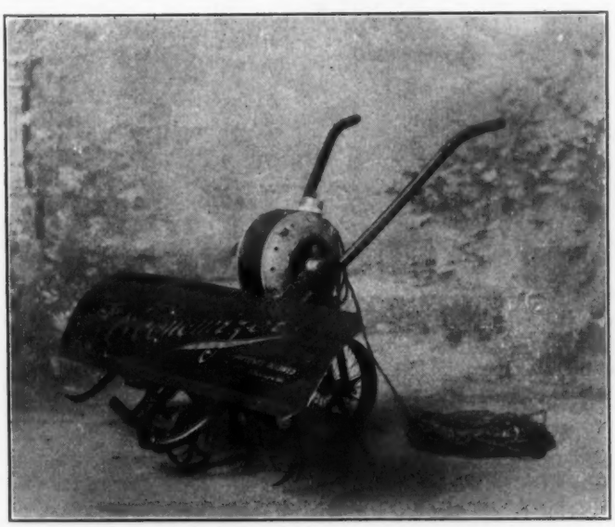


Fig. 1—Electric Cultivator for Intensive Farming.

wheel with suitable gearing provide means for driving the traction wheel and the shaft supporting the teeth. The teeth on the shaft cut into the ground to a depth which may be regulated, cutting the surface of the land into a blanket of fine dust without breaking the delicate roots of plants near the surface, but effectually closing the minute pores of the earth so that the moisture does not escape, but is preserved for the growing plants. The teeth on the revolving shaft may be taken out as desired to allow cultivation close up to the rows of plants and yet allow space so that the machine will pass over the rows without injury to them. A mud-guard is provided to prevent the particles of earth from flying in the air.

The machine can be easily fitted with a cutter bar for mowing, the attachment being shown in front. The revolving teeth then

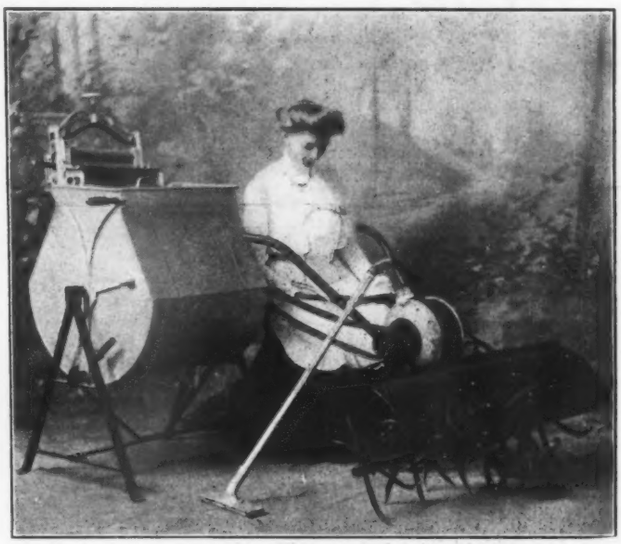


Fig. 2—Electric Cultivator Motor Connected to Washing Machine and Vacuum Cleaner.

act as a tedder to gather the cut grass or hay. The motor may be used also to drive a vacuum cleaner, washing machine or other electrical conveniences of the household. Fig. 2 illustrates the manner in which it is used for this purpose. The whole machine weighs 100 lb. and is provided with roller bearings.

PROTECTIVE DEVICES FOR HIGH-TENSION CIRCUITS.

For the opening of circuits carrying heavy loads at high voltage no device has proved more satisfactory than the oil-immersed switch developed particularly for this service. These switches possess the one disadvantage of being expensive. Where only a small amount of power is to be utilized it is essential to employ some circuit-opening device less expensive than the high-tension oil switch. In Fig. 1 is shown a device employed for this purpose. It consists of a fuse mounted in a suitable holder which acts as a disconnecting switch for the circuit and permits interrupting the charging current of a line or the magnetizing current of a transformer, at the same time disconnecting the fuse holder from the circuit so that a fuse can be easily and safely removed or replaced. These fuses, under proper conditions, furnish adequate protection for lines and apparatus because by reason of their property of generating a high pressure at the rupturing point of the fuse and their quick action the circuit is opened with little if any more disturbance than where an oil switch is used.

There are a number of engineering features which should be carefully considered before deciding upon the use of fuses. Fuses should not be used: (1) When the current to be ruptured exceeds the rating of the fuse or when the capacity of the system exceeds the rupturing capacity of the fuse; (2) where the arc formed by the blowing fuse is objectionable; (3) where short interruptions of service, due to the time necessary to replace fuses, are an objection; (4) where overloads or short-circuits are frequent, and circuits should be opened selectively after a certain time interval.

In order to provide automatic protection for apparatus under abnormal conditions of overload or short-circuits two schemes are now in general use. The first, and oldest, involves series transformers (Fig. 3) the primaries of which are connected in the high-voltage circuit to be protected. The secondary winding, suitably insulated from the primary, is connected either directly or through suitable relays to the coil which attracts the tripping mechanism of the switch controlling the circuit. In the second scheme use is made of relays thoroughly insulated from the ground, the solenoids of which are connected directly in the main circuit. These operate the tripping mechanism of the switch either directly by means of insulating rods or by means of an auxiliary source of power and a trip coil on the switch mechanism. These relays are designed only as single-pole units, one of which is connected in each line wire, and are not suitable for conditions which require the bringing together of two high-voltage circuits in one unit. A view of a high-potential series relay is given in Fig. 2. A very satisfactory indicating device for use on high-voltage circuits is formed by mounting a standard ammeter on a suitable insulator to prevent leakage to ground, as shown in Fig. 5. These instruments are connected directly in the main circuits and are so mounted that accidental contact with them by the station attendant is impossible. These instruments are installed in those installations which lend themselves to the use of series relays and together they form a very compact and cheap equipment.

Where wattmeters or watt-hour meters are required series transformers are necessary. Such a transformer equipped with an oil-filled terminal is shown in Fig. 3. A transformer of this type can be used to operate protective devices as well as to carry the instrument load.

Fig. 1—Combined Fuse and Disconnecting Switch.

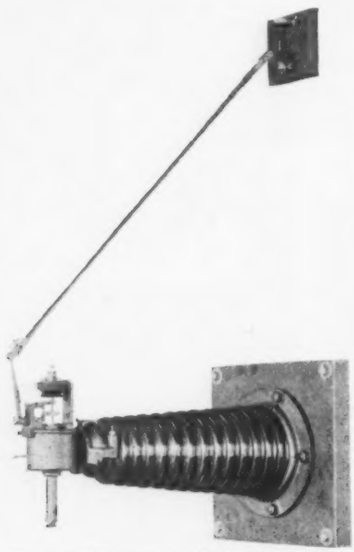


Fig. 2—High-Potential Series Relay Mounted on Post Insulator.

Fig. 3—Series Transformer.

Fig. 4—Link Insulator, Suspension Type.

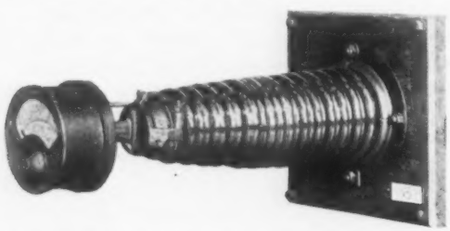


Fig. 5—Ammeter Mounted on Post Insulator.

The most difficult problem in high-voltage development and one on which the success of any energy transmission scheme depends has been the production of suitable insulation for the lines. As the lines are exposed to all weather conditions, traverse long stretches of exposed country and are compelled to make numerous bends and to follow the natural grades it has been necessary to produce insulators to meet any and all service conditions.

With the old-style pin insulator construction the line e.m.f. was limited to about 60,000 volts, due to the great weight of the insulators for higher voltages and the high cost of towers, which had to be erected at close intervals. Higher voltage transmission has been made possible by the introduction of the insulator of the link type, of which two forms are in use, known as the suspension type and the strain type. Each insulator consists of a number of porcelain units joined together by suitable links, the number of units in series being varied in proportion to the voltage.

An important element in a transmission line is the disconnecting switch for isolating one part of the line from another. Use is frequently made of switches of the knife-blade type, the spacing and break distances of which depend upon the voltage. These switches are not, as a rule, intended to open a circuit under load. In Fig. 6 are shown open-air switches designed for interrupting a moderate amount of power. They are mounted on a pole or tower structure and may be operated from the ground by means of a suitable mechanism. The final breaking of the arc is accomplished on metal horns which, bending upward and outward, allow the arc to follow its natural course upward and to rupture itself at the ends of the horn.

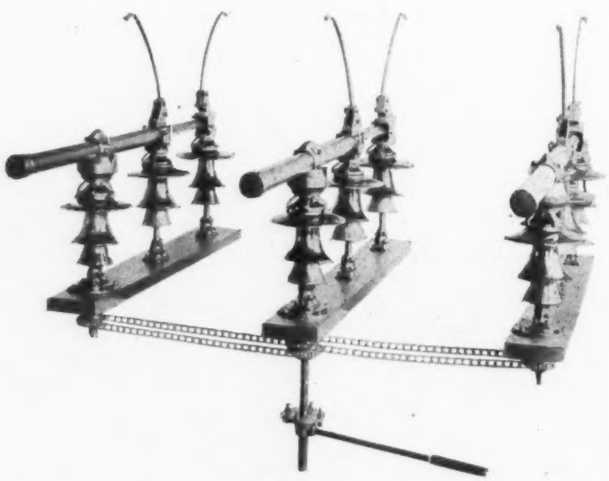


Fig. 6—70,000 Volt T. P. S. T. Bolt-Type Disconnecting Switch.

The above-described devices have been developed by the General Electric Company, Schenectady, N. Y.

Industrial and Commercial News

THE WEEK IN TRADE.

BETTER distribution at retail, due to the cooler weather, is the principal trade feature worth reporting for the past week. The jobbers and wholesalers report some larger filling-in orders, for which the advance of the season and the previous light buying of the retailers are mainly responsible. At best, however, there is considerable room for improvement in the season's trade. While there is more doing on the spring account, buyers are as yet very conservative and in many lines seem disposed to hold off, believing that prices will soon be lower. On the other hand, manufacturers are displaying no particular anxiety to book heavy orders for future delivery on account of the present high levels of raw materials. The agricultural sections of the country are exhibiting more prosperity than the industrial sections, but in the agricultural sections there is at present a disposition to hold crops for higher prices. The industrial situation as a whole is comparatively quiet, and outdoor construction work becomes less active as the season advances. The gross earnings of railways are diminishing, and this is causing the railway managers to go slow in ordering equipment on anything like a liberal scale. There was some further buying of steel rails during the past week, the total amounting to about 73,000 tons, and it is given out that a number of roads are now negotiating their season's requirements. It is also said that quite a number of cars will probably be ordered before the end of the year. The demand for structural material is very light, but the new business in wire products and in tubes shows very satisfactory increases. The favorable returns of export trade for October have done much to encourage the business community, and it is generally believed that as prices decline exports will grow. Collections, especially throughout the West and South, are improved, and are now classed as from "fair to good." Business failures for the week which ended Nov. 17, as reported by *Bradstreet's*, were 248, as against 207 the previous week, 232 in the same week of 1909, 273 in 1908, 265 in 1907 and 212 in 1906.

THE COPPER MARKET.

COPPER-SELLING agencies made a stronger effort last week to secure business from domestic consumers than has been made for many months. Some price concessions were offered, and an especial solicitation was made for liberal orders. It is believed that they succeeded in disposing of between 7,000,000 and 8,000,000 lb. of electrolytic copper for December and January shipment. Most of this business was taken at from 12 7-8 to 13 cents. Wire drawers, brass foundries and electrical companies were the principal purchasers, and the sales were mainly in lots ranging from 250,000 to 500,000 lb. There was very little export trade during the week, the prices asked here being almost as high as the delivered price in Europe. In the early part of the week there were some speculative transactions in standard warrants in London, and this in a measure supported the local market. There is still much gossip in the copper market over the last report of the Copper Producers' Association. The considerable reduction which was made in the surplus stock in this report was largely offset by the disappointing discovery that the production of copper had not been curtailed. The optimists in the market prophesy that the next report will show a material reduction in the production figures. The exports reported by the Customs House through the Metal Exchange for the month of November, including Nov. 21, are 20,014 tons. Especial attention is now being paid to these figures, owing to the fact that in the reports for last month the statistics of the government were 20,000,000 lb. below the export statistics of the Copper Producers' Association. Imports continue at about the same rate and are not nearly as high as they were in the summer. The daily call on the Metal Exchange Nov. 21 quoted standard copper as per the accompanying table

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.50	12.65	.....
November	12.50	12.70	12.65
December	12.55	12.75	12.65
January	12.60	12.80	12.70
February	12.70	12.90	12.80
March	12.75	12.95	12.85

The London market, Nov. 21, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	57 17 6	57 17 6
Standard copper futures	58 16 3	58 16 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 0	53 7 6
Best selected	65 10 0	57 15 0

INDUSTRIAL AND COMMERCIAL NOTES.

Studebaker Electric Commercial Vehicle Campaign.—During the annual meeting of the branch house managers of the Studebaker organization, which took place last week at South Bend, Ind., a notable incident was the announcement to the branch managers by the administration of its determination to prosecute vigorously a broad electric commercial vehicle program. It was made known that the executive committee had for some weeks previously examined into the progress of the energetic campaign, largely of an investigating character, which has been conducted for the past three years; ways and means of a forceful nature were decided upon to broaden this work and the branch house executives were instructed to spare no effort or expense in carrying out the details of the program announced. It was stated that with relation to locating the commercial vehicle manufacturing plant at Detroit, which has been under consideration, it was decided to retain this division of the production department at South Bend and it is very likely that additional buildings will be erected to meet the demand for electric commercial vehicles which is reasonably within expectation as the result of the new campaign coming into effect. The execution of the field work in the campaign has been delegated to William P. Kennedy, who, in addition to his advisory function to the administration as consulting engineer, was appointed sales manager of the commercial automobile department with extensive authority.

Electrical Devices for the Holidays.—There has been a general movement all over the country to push the sale of electrical devices for the holiday trade. This movement has had a wide growth, and has been pushed forward not only by supply dealers, but in many parts of the country by central stations. There has been a special campaign made for this business, and it has been extremely successful. This trade covers a wide range of supplies, not only electrical ornaments and novelties, but all kinds of household devices, especially percolators, toasters and chafing dishes, which have had an extensive sale for the Christmas trade. The representatives of the General Electric Company in all parts of the country have been especially active in securing this class of business. Another jobber in holiday devices, who controls the output of a New York factory, says that the demand upon him has been so heavy that his plant was entirely unable to fill it. This salesman represents only novelties, Christmas trees, fancy lights, etc., and these, he says, have sold beyond all expectations.

General Electric Managers.—The annual meeting of the district managers of the General Electrical Company was held in Schenectady last week. No business of a public nature was transacted, but a thorough discussion of the trade situation in all parts of the country was held. The reports from these managers in all sections of the United States were very encouraging. Almost without exception, they declared that business seems to be improving, and that the outlook for a very large volume next year is extremely bright. Business has been especially good in lamps and electric meters.

Heany Lamp Company.—The Heany Lamp Company expects to begin operations in its new factory at Weehawken, N. J., before the beginning of the new year. This factory will have when in full operation a capacity of 10,000 tungsten lamps a day. The officials of the company state that the new facilities are very badly needed on account of the heavy rush of business. The company is unable to fill its orders at this time, and its present factory is working overtime in an effort to keep up with the heavy demand for lamps.

Westinghouse Companies Prosper.—In addition to the very satisfactory business being done by the Westinghouse Electric & Manufacturing Company, which was referred to in our last issue, it is also reported that the other companies owned by the same interests are equally successful. The Union Switch & Signal Company, which closes its fiscal year Dec. 31, will show the most favorable report the management has ever been able to present. Judged by the business that the company has done during the year up to Nov. 1, the entire gross earnings for the year will be over $6,000,000, and the net earnings will probably exceed $1,250,000. This exceeds by over $1,000,000 the highest previous yearly gross record. The Westinghouse Machine Company, the fiscal year of which ends March 31, will also show gratifying results. During the present year orders for turbines, steam engines, gas engines, condensers and automatic stokers have been very large, and in October the company reported record-breaking shipments representing about $600,000 for that month alone. Since coming out of the hands of the receivers two and a half years ago the company has added largely to the field of its production, and it is now manufacturing several products which were not originally in its catalogue. The Westinghouse Air Brake Company is continuing to do a large business, and the additions to the works at Wilmerding, which have recently been completed, are now in operation and the company is beginning to reap the benefit from these improvements. The Westinghouse Electric & Manufacturing Company last week leased an eight-story building at 429 First Avenue, Pittsburgh, for a term of years, and will move its North Side warehouse to this location. A repair department will also be established in this building.

Proposal to Operate New Subway.—William G. McAdoo, president of the Hudson & Manhattan Railroad Company, has written a letter to the Public Service Commission offering to equip and operate the proposed Tri-Borough subway system after the completion of the plans. Mr. McAdoo suggests the postponement of the construction of the Broadway-Lexington Avenue Brooklyn branch, the Canal Street branch and the elevated arms extending into the Bronx. He suggests building a subway under Wall Street and the East River to Brooklyn and a connecting line under Broadway between the Hudson & Manhattan station at Thirty-third Street and the Tri-Borough line at Tenth Street. Mr. McAdoo also suggests a connection with his proposed line at Grand Central Station and a moving platfrom from his Thirty-third Street station to the Pennsylvania Railroad terminal. It is estimated that the cost of equipment and rolling stock will be about $50,000,000. Frank J. Sprague, electrical engineer, has also written the commission that within sixty days after an acceptable contract for construction of the Tri-Borough system has been made he will put in a bid for operation of the line.

Telephones on New England Railroads.—The railroads operating in New England have been especially active in the movement to replace the telegraph with the telephone for train dispatching. The New York, New Haven & Hartford has in operation telephone circuits covering 100 miles of its road from Northhampton to New Haven. In this section there are twenty-nine telephone stations, which are equipped with test panels, selectors and flexiphones. The Boston & Maine has in operation sixty-eight stations covering the White Mountain and Concord divisions. The Central Vermont has just ordered a telephone equipment to cover its northern division from St. Albans to Windsor. On this stretch of 150 miles there will be thirty-eight telephone stations. The Boston & Albany has in operation telephone equipment covering all of its main line and all branches from Boston to Albany. On this division there are 165 stations. All of the equipment for these New England roads was furnished by the Western Electric Company, which has supplied about 90 per cent of the telephone equipment for railroads now in use in this country.

Testing Edison Battery Car.—The large two-truck Beach car constructed by the Federal Storage Battery Company, fitted with Edison storage batteries, described in our issue of Oct. 27, was tested very thoroughly last week on the Erie Railroad in the neighborhood of Orange, N. J. Quite a number of prominent railroad officials and engineers were present at these tests, including F. D. Underwood, president of the Erie Railroad. In fact, the tests were made especially to give the officials of the Erie an idea as to the suitability of this type of car for service on some of the branch lines where the traffic is light. The officials of the Federal Storage Battery Company say that the performances of the car under various weather conditions exceeded their expectations. The car made a higher speed than had been promised for it, and was operated at a less expenditure of energy than had been estimated. This is the car that was built for the South Shore Traction Company. It is now ready for service, but will be used for demonstration purposes for a few weeks before being delivered to its ultimate owners. The South Shore company intends to use it in service across the Queensboro Bridge.

Electrification in Boston.—The reports of the engineers of the New York, New Haven & Hartford, the Boston & Alband and Boston & Maine Railroad systems who investigated the matter of the electrification of that portion of the three roads within the metropolitan district of Boston have been submitted to the joint Board on Metropolitan Improvements of Massachusetts. They show that the work as outlined would cost in the neighborhood of $40,000,000. In these reports it is agreed that to run electric trains in the metropolitan district would result in a large deficit for the Boston & Albany in operating expenses. A. H. Smith, vice-president, speaking for the New York Central railroad, of which the Boston & Albany is a part, says that in view of this deficit the railroads should have authority to assess all passengers and traffic using the facilities with a terminal charge sufficient to bear the financial burden imposed with some profit to the operating company. The Boston & Maine and New Haven roads would be required to electrify 461 miles of track and the Boston & Albany 128 miles.

Western Power Company.—The report which has been published in the West that the Great Western Power Company, which is a subsidiary of the Western Power Company, was making preliminary surveys and preparing plans to build a four-mile tunnel from Bartees Bar to Big Bar, on the north fork of the Feather River, has been denied explicitly by one of the officials of the company in the New York office. This authority says that there is no intention of undertaking this development at the present time, and that no preliminary work is now being done. Eventually, he says, this development may be carried out, as this is one of the sites which the Western Power Company has in reserve when the demand for its energy will warrant the investment. The construction of such a development, it is estimated, would cost $10,000,000, and it would require several years to build it. The company also has in reserve a prospective development of immense possibilities at Big Meadows, Cal. No work is contemplated on this site for many years to come.

Western Electric Company.—For the twelve months ending Nov. 30 the gross sales of the Western Electric Company, according to present estimates, will be about $62,000,000. Allowing a profit of 5 per cent on its business, which is a trifle less than last year's margin, the company's net earnings will be about $3,100,000. The surplus, after paying dividends and fixed charges, would, therefore, be about $1,237,000, or a little better than 8 per cent on the capital stock. The company is now spending large sums of money enlarging its plant and concentrating its manufacturing interests at Hawthorne. It has been announced that the company will probably extend its present annual report to cover thirteen months, in order to make its fiscal year correspond hereafter with the calendar year.

Westinghouse Turbine McAlpine-Melville Reduction-Gear Railway Equipment.—The San Diego Electric Railway Company, of San Diego, Cal., has just placed an order with the Westinghouse Electric & Manufacturing Company, Pittsburgh, for two 1000-kw, 600-volt, 514-r.p.m. generators to be driven by Westinghouse-Parsons low-pressure steam turbines running at 3600 r.p.m. The generators and turbines will connect through Melville-McAlpine reduction gears. In addition to this equipment the Westinghouse company will shortly ship one 1200-kw, 600-volt, 80-r.p.m. engine, type D. C. generator, to the same company.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Lancaster, Pa.; Muscatine, Ia.; Coldwater, Ohio; Buffalo, N. Y.; Sylvia, Kan.; North Yakima, Wash.; Olivet, Mich.; Bridgewater, Mass.; Winnipeg, Man., Can.; Bowling Green, Ky.; Chase City, Va.; McPherson, Kan.; Islip, N. Y.; Newport, R. I.; Manistee, Mich.; Muskegon, Mich.; Vine Grove, Ky.; Fairview, Okla., and Marseilles, Ill.

Financial.

THE WEEK IN WALL STREET.

ALTHOUGH the net result of the trading in Wall Street last week was in almost every instance an advance, there seems to be little confidence in the permanence or stability of the upward movement. The total sales for the week were almost 2,500,000 shares, but this does not indicate that the outside public has taken any part in the transactions. It would be hard to imagine a more thoroughly professional market than has existed since the second day after election. Outsiders seem wholly indisposed to speculate and the buying for investment is very small. The sharp decline which immediately followed the election, and which indicated so clearly that the insiders who had loaded up at low prices were attempting to unload upon the general public, has had a tendency to rebuff any inclination that might have been felt toward speculation. When it is so plainly demonstrated that the market can be jerked up and pulled down at the will of professional traders, it is not surprising that the investor and the business man prefer to keep their money at home. During the week there was no news feature calculated to stimulate a buying movement, except the announcement that some of the railroads had released heavy orders for steel rails. The monthly reports of earnings of the railroads are not considered satisfactory, nor is it believed that the prospect of securing an advance in rates is very bright. At the present moment it is considered that the market is somewhat oversold. This may explain the determination of the powerful interests that are generally the leaders in manipulation to hold prices at a higher level than the condition of commercial business warrants. There is still plenty of money, and the market for this is fairly easy. Borrowers, however, are not particularly eager. Quotations Nov. 21 were: Call, 2½@2¾ per cent; 90 days, 4¼@4½ per cent. The quotations in the table are those of the close Nov. 21.

NEW YORK.

	Nov. 14.	Nov. 21.	Shares Sold		Nov. 14.	Nov. 21.	Shares Sold
All.-Ch.	9⅞*	9⅞*	——	Int.-Met., pf.	56½	112½	4,100
All. Ch., pfd.	31*	32	300	Mackay Cos..	93*	95½	300
Amal. Cop...	69½	69½	69,200	Mackay C.,pf.	74½*	74½*	——
Am. D. T....	20½*	20½*	——	Man. Elev...	141*	141½	200
Am. Loco....	39¼	40	3,100	Met. St. Ry..	15*	15*	——
Am. Loc.,pfd.	106	106¾*	200	N.Y.&N.J.Tel.	139¼*	139¼*	——
Am. Tel. & C.	84*	84*	——	Steel, com...	78⅞	80	715,700
Am. T. & T..	141⅞	142½*	13,700	Steel, pfd....	117⅞	118¼	4,995
B. R. T.....	76⅞	78	17,400	W. U. T....	71	72¾	1,600
Gen. Elec....	153½	156¼	1,200	West'h, com..	71	71⅜	1,700
Int.-Met	21¼	20⅞	8,500	West'h, pfd..	124*	124*	100

PHILADELPHIA.

	Nov. 14.	Nov. 21		Nov. 14.	Nov. 21
Am. Rys.....	43*	43	Phila. Elec.....	15½	15⅞
Elec. Co. of A....	11¾*	11¾*	Phila. R. T.....	16	17⅝
Elec. St. B'ty.....	47½	48	Phila. Trac.....	82	83*
E. S. B'ty, pfd....	30*	30*	Union Trac.....	39¼	41½

CHICAGO.

	Nov. 14.	Nov. 21		Nov. 14.	Nov. 21
Chi. City Ry.....	170*	170*	Chi. Tel. Co.....	122*	123*
Chi. Rs., Ser. 1.....	76*	82½	Met. El. Co.....	21*	21*
Chi. Rs., Ser. 2.....	20¼	22¾	Met. El., pfd.....	63½*	62
Com. Edison	116	115½	Nat'l Car.....	125*	125*
Chi. Subways.....	4¼	4⅞*	Nat'l Car., pfd.....	118¾	118¾

BOSTON.

	Nov. 14.	Nov. 21		Nov. 14.	Nov. 21
Am. T. & T.....	141⅝	142½	Mex. Tel.....	5¾*	5
Cum. Tel.....	150*	145*	Mex. Tel., pfd.....	6¾*	6
Edison E., Ill.....	282	288	N. E. Tel.....	137	137
Gen. Elec.....	153⅝	156¼	W. T. & T.....	17*	18*
Mass. E. Ry.....	20¼	20½	W. T. & T., pfd....	90*	90½*
Mass. E. Ry., pfd..	86¼	88¼*			

*Last price quoted.
Shares sold for week Nov. 14 to Nov. 19.

FINANCIAL NOTES.

Georgia Power Company.—The consolidation of the properties and franchises of the North Georgia Power Company and the Etowah Power Company into the Georgia Power Company has been approved by the Railroad Commission of Georgia and permission given to issue $20,000,000 of stocks and bonds. The outlines of the plans of this company were given in the issue of Nov. 17. Bonds will be issued as soon as a mortgage can be prepared and recorded, of which the Knickerbocker Trust Company of New York will be named as trustee. It has not yet been determined which one of several hydroelectric developments will be taken up first. The S. Morgan Smith Company, of York, Pa., is not interested in the project, as at first reported, but the proposition is being handled by C. Elmer Smith, an officer of that company, in connection with foreign interests.

General Motors Company.—The annual meeting of the stockholders of the General Motors Company was held in Jersey City last week. Ten of the eleven directors resigned, and their places on the board were filled by representatives selected by the bankers who took the company's recent issue of $15,000,000 five-year 6 per cent notes. Under the terms of the loan the bankers furnishing the funds were to be allowed to name the majority of the board of directors until the notes were redeemed. W. C. Durant, vice-president of the company, was the only one of the old directors who was re-elected. The new members of the board are: Anthony N. Brady, James J. Storrow, Albert Strauss, J. H. McClement, Nicholas L. Tilney, Richard Lukeman, Jr., George Richards, Jr., Benjamin F. McGuckin, Herbert L. Carlebach and Arthur P. Bush, Jr.

Electric Boat Company.—In explanation of the passing of the regular quarterly dividend of 2 per cent on the preferred stock of the Electric Boat Company, President I. L. Rice says: "The company has a large amount of business on hand and the outlook is excellent, and this has required the use at present of all the capital and earnings. It was the opinion of the directors that under the circumstances it would be wise to suspend dividends for the present." The passing of this dividend provides about $55,000 of working capital per quarter. The company was organized in 1899 and has outstanding $4,999,600 of common stock and $2,627,500 of 8 per cent non-cumulative preferred. Dividends have been paid for the last seven years upon the preferred stock.

Kings County Electric Light & Power Company.—The indications now are that the Kings County Electric Light & Power Company for the fiscal year which ends Dec. 31 will show a surplus available for dividends equal to about 10 per cent on the $10,000,000 outstanding capital stock. The gross earnings will probably be more than $4,000,000 and the net earnings about $2,000,000. During the calendar year of 1909 the company increased its number of consumers by over 3000, or about 23¼ per cent. In view of the unusually favorable showing made by the company thus far in the current year, it is believed that the increase in the number of consumers will exceed last year's record.

Cataract Power & Conduit Company Bonds.—Spencer Trask & Company, New York, are offering at par a large block of the first mortgage 5 per cent bonds of the Cataract Power & Conduit Company. These bonds are a first mortgage on the entire property and franchises of the company, which distributes in Buffalo power received from Niagara Falls. The company is now paying 6 per cent on its $2,000,000 stock. The outstanding bonds amount to $1,384,000 and they are due in 1927.

Union Switch & Signal Company.—A special stockholders' meeting of the Union Switch & Signal Company has been called for Dec. 14 to vote on a proposition to increase the capital stock from $2,500,000 to $5,000,000 by issuing 50,000 shares of a par value of $50. It is proposed to authorize the board to issue the new stock to stockholders in payment of dividends and also to offer it to them for subscription. The present capitalization is $500,000 preferred and $2,000,000 common.

Gary & Interurban Railway Bonds.—Lawrence Barnum & Company, bankers of New York and Philadelphia, having sold a large portion of the $1,000,000 first refunding mortgage 5 per cent bonds of the Gary & Interurban Railway, are now offering the balance at 95 and interest. This is the new electric railway of the United States Steel Corporation's manufacturing city. The bonds are due July 1, 1950, and subject to call at 105.

Detroit-Edison Company.—The quarterly dividend of the Detroit-Edison Company has been increased from 1½ per cent to 1¾ per cent. This increase has been prompted by the exceptionally favorable earnings that have been shown thus far in the current year. These earnings, it is said, after deduction of the allowance made for depreciation, are at the rate of about 14 per cent per annum.

Bronx Gas & Electric Company.—The Public Service Commission of the First District, New York, has ordered a hearing for Nov. 28 on the application of the Bronx Gas & Electric Company for permission to issue $153,000 5 per cent bonds. The proceeds of these bonds will be devoted to extensions and improvements.

Southern Pacific's Electric Deal.—An official statement of the deal between the Southern Pacific Railroad Company, the Pacific Electric Railway Company and Henry E. Huntington, which was referred to in our last issue, is now given out. For several years the Southern Pacific has owned 45 per cent of the stock of the Los Angeles Railway Company and Mr. Huntington has owned the balance. The stock of the Pacific Electric Railway Company has been owned equally by Mr. Huntington and the Southern Pacific Railroad. Under the new deal Mr. Huntington now acquires from the Southern Pacific Railroad its stock in the Los Angeles Railway, thus becoming its sole owner, while the Southern Pacific Railroad buys out Mr. Huntington's interest in the Pacific Electric Railway, thus becoming its sole owner. The Southern Pacific also acquires control of the interurban portion of the Los Angeles & Redondo Railway lying between Hawthorne and Redondo, while the urban portion between Hawthorne and Los Angeles will hereafter belong to the Los Angeles Railway Company. Mr. Huntington's new interests have been reorganized under the corporate name of the Los Angeles Railway Corporation, having a capitalization of $20,000,000. The active management of this property will be in the hands of Howard E. Huntington. The reorganization of the Pacific Electric Railway properties has not been completed, but a new company will probably be formed which will be called the Pacific Electric Corporation. The present capitalization of the Pacific Electric Railway Company is $10,000,000, but its assets are several times that amount. The ownership of the ten-story Pacific Electric building in Los Angeles where the lines of the railway enter has been transferred to the Southern Pacific Railroad. The Southern Pacific, it is said, will immediately invest large sums in the Pacific Electric Railway properties in extensions and improvements of equipment. The new directors of the Pacific Electric Railway are: W. H. Herrin, president; Paul Shoup, vice-president; William Hood, Walter F. X. Parker, J. W. McKinley, Eps. Randolph and R. C. Gillis. The new directors of the Los Angeles Railway Corporation are: H. E. Huntington, president; Howard E. Huntington, vice-president; W. E. Dunn, Albert Crucher, J. E. Brown, C. A. Henderson and J. C. Ward.

Boston Edison Company Stock.—For the last few weeks the stock of the Edison Illuminating Company of Boston has been very strong in that market, and has sold as high as 292½. The stock pays 12 per cent dividends, making it at that figure a trifle more than a 4 per cent investment, but it is not unreasonable to anticipate an extra dividend some time during the winter. It is also believed that there will be a further reduction in the rates to consumers. One feature that adds to the strength of this stock at the present time is the belief that the company will be able to secure a contract for furnishing power to the steam roads entering Boston upon the completion of the electrification of these lines within the metropolitan district. The Edison company for the past five years has expended large sums in bringing its plant to the position where it is able to turn out energy at a lower cost than at any time in the company's history. There is no question that it would be able to supply the railroads with the energy required at a cheaper rate than they could generate it themselves, and in addition to this it would obviate the necessity of large capital investments by the railroad companies.

North Carolina Electrical Power Company.—A mortgage was filed at Asheville, N. C., last week by the North Carolina Electrical Power Company to the Wachovia Loan & Trust Company for $2,000,000. The mortgage covers the various real estate holdings of the company in Western North Carolina, together with several power developments now in operation and in course of construction. The North Carolina Electrical Power Company recently merged with the W. T. Weaver Power Company, assuming at the time all of the bonded indebtedness of that company, which amounted to about $225,000. The company also had some bonds of its own outstanding.

DIVIDENDS.

Blackstone Valley Gas & Electric Company, preferred, quarterly, 1½ per cent, payable Dec. 1.

Brooklyn Rapid Transit Company, quarterly, 1¼ per cent, payable Jan. 2.

Citizens' Traction Company, Pittsburg, semi-annual, 1½ per cent, payable Nov. 17.

Detroit Edison Company, quarterly, 1¾ per cent, payable Jan. 15.

General Motors Company, preferred, 3½ per cent, payable Nov. 30.

Kings County Electric Light & Power Company, quarterly, 2 per cent, payable Dec. 1.

National Lead Company, quarterly, ¾ per cent, payable Dec. 31.

New England Telephone & Telegraph Company, quarterly, 1½ per cent, payable Dec. 31.

New York and Queens Electric Light & Power Company, quarterly, 1¼ per cent, payable Dec. 1.

Norfolk (Va.) Railway & Light Company, 2½ per cent, payable Dec. 1.

Rochester Railway & Light Company, preferred, quarterly, 1¼ per cent, payable Dec. 1.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
American Light & Traction Company:					
October, 1910	$356,685	$11,126	$345,559	.....	.....
October, 1909	313,847	8,865	304,902	.....	.....
Bangor Railway & Electric Company:					
October, 1910	49,593	20,041	29,552	$13,734	$15,818
October, 1909	49,173	20,041	29,132	13,663	15,469
British Columbia Electric Company:					
September, 1910	311,803	176,654	135,149	.....	.....
September, 1909	240,186	130,320	109,865	.....	.....
Detroit Edison Company:					
October, 1910	249,185	152,279	96,906	47,744	40,162
October, 1909	182,871	107,273	75,598	42,087	24,511
Fairmont & Clarksburg Traction Company:					
October, 1910	58,503	19,385	39,118	13,112	26,006
October, 1909	41,432	14,353	27,079	12,654	14,425
Hudson & Manhattan Railroad Company:					
October, 1910	351,216	157,183	194,033	192,088	1,945
October, 1909	289,121	148,787	148,787	145,268	*4,927
Keystone Telephone Company of Philadelphia:					
October, 1910	96,345	48,316	48,029	24,519	23,510
October, 1909	91,561	45,544	46,016	24,981	21,035
Kings County Electric Light & Power Company:					
October, 1910	355,238	172,712	182,526	112,790	69,736
October, 1909	299,977	159,638	140,339	87,260	53,079
Lewiston, Augusta & Waterville Street Railway Company:					
October, 1910	43,090	17,162	3,382	.....	.....
October, 1909	43,332	18,564	3,484	.....	.....
Portland (Ore.) Railway Light & Power Company:					
October, 1910	$03,485	225,118	278,367	152,229	126,138
October, 1909	426,708	188,721	237,987	126,873	111,114
Schenectady Railway Company:					
Quarter ended Sept. 30, 1910	352,479	189,265	163,214	38,555	127,507
Quarter ended Sept. 30, 1909	296,164	160,018	136,146	36,598	102,948
Syracuse Rapid Transit Railway Company:					
Quarter ended Sept. 30, 1910	409,557	278,852	130,705	78,883	34,345
Quarter ended Sept. 30, 1909	371,868	292,014	79,855	76,323	20,679
Toledo Railways & Light Company:					
September, 1910	239,415	153,407	86,008	78,102	8,261
September, 1909	217,738	121,779	95,959	75,484	20,833
Westchester Electric Company:					
Quarter ended Sept. 30, 1910	172,753	109,604	63,149	9,606	47,115
Quarter ended Sept. 30, 1909	150,345	100,468	49,876	9,721	35,070

* Deficit.

General News

Construction News.

BESSEMER, ALA.—It is reported that a measure will soon be submitted to the City Council advocating the installation of a municipal electric light plant in Bessemer.

BIRMINGHAM, ALA.—The Coosa River Electric Power Company has applied to the City Council for a franchise to erect transmission lines throughout the city for the distribution of electricity for lamps and motors.

BIRMINGHAM, ALA.—Application has been made to the Board of Revenue of Jefferson County by the Grandview Street Railway for permission to construct an electric railway over certain roads in this county. E. W. Jordan is interested in the project.

BIRMINGHAM, ALA.—Announcement has been made that the Tidewater Railroad Company has awarded the contract for the construction of its proposed electric railway. Work will begin on the section between East Lake and Bessemer, a distance of forty-six miles. J. M. Dewberry is president of the company.

HAZEN, ARK.—It is reported that contracts have been placed for machinery for the plant of the Hazen Power & Light Company. Work will soon begin on construction of the buildings, which are to be completed by March, 1911. W. H. Fox is president of the company.

ALAMEDA, CAL.—The City Council is reported to have voted to issue $12,000 in bonds, the proceeds to be used for the construction of a new power house to replace the present building for the municipal electric light plant on Park Street.

FRESNO, CAL.—It is reported that the San Joaquin Light & Power Company has made arrangements for financing its $1,500,000 refunding bonds issue. The company is building a large dam on the San Joaquin River, at Crane Valley. The proposed dam will be 1865 ft. long, backing the water for miles at a minimum depth of 125 ft. and impounding 5200 acre ft. It is proposed to supply electricity in the oil fields and valley lands between Bakersfield and Merced, and particularly to operate pumps on the ranches, where abundance of water may be obtained from wells. The water will be carried through three miles of conduit to the power house. It is said that there will be no attempt to complete the third unit of the power plant until next March. Two units of 5000 hp each have been cut in. The Kern Oil Fields Company has recently placed orders for 100 General Electric motors and for about the same number of Westinghouse motors for use in its property.

NEVADA CITY, CAL.—The Pacific Gas & Electric Company, which has its principal office in San Francisco, Cal., has recently filed articles of incorporation in Nevada City, Cal., with a capital stock of $3,000,000. Among the directors are: E. de Sabla, John Martin, F. G. Drum, G. W. McErnerny.

OAKLAND, CAL.—A project is on foot to compel the Oakland Gas Light & Heat Company to reduce its rates for electrical service. The agitation was started by the fact the City of Alameda has reduced the price of electricity for cooking and heating purposes from seven to four cents per kw-hour. The installation of a municipal plant is also under consideration and may be made an issue in the next mayoralty campaign.

OROVILLE, CAL.—Notices of appropriation of large quantities of water have been filed, to be taken from the Middle Fork, Falls River and Bear Creek. All applicants state than an electric power plant is to be erected on a high hill, near the junction of the Middle Fork and Fall River. Paul Rohrig has filed notice of appropriation of 20,000 in. to be taken from the Middle Fork of the Bear River, near the junction with Bear Creek, in Plumas County, which is to be conveyed by a 16-ft. ditch for a distance of twenty-two miles to the junction of the Fork and Falls River. The application states that a concrete dam, 25 ft. high, 10 ft. through and 200 ft. long, is to be built at the point of the diversion of the stream.

RED BLUFF, CAL.—Three deeds have been filed conveying to the Northern California Power Company the right to construct and maintain ditches, flumes and tunnels, transmission lines and wagon roads across the lands of Elmer L. Fullwright and Willis H. Stone. The lands are located about eighteen miles northeast of Red Bluff.

SAN BERNARDINO, CAL.—The Board of Supervisors has granted the Pacific Light & Power Company a fifty-year franchise to erect transmission lines for the distribution of electricity on Orange Grove Avenue, in the county of San Bernardino.

TURLOCK, CAL.—The plant and holdings of the Turlock Electric Company have been taken over by the La Grange Water, Light & Power Company, of La Grange, Cal.

WILLOWS, CAL.—The new electric company which is being formed by C. R. Wickes and others has applied to the Board of Trustees for a franchise to erect transmission lines through the streets in Willows. The company proposes to secure electricity for operating its system from the transmission line of the Sacramento Valley Power Company.

WONDER, CAL.—Surveys have been completed by the Mono Electric Power Company for the erection of its proposed transmission line from Lucky Boy to Wonder, a distance of about seventy-five miles, to be completed by Feb. 15, 1911. The line will carry 60,000 volts and will supply electricity to the mining companies and other industries for lamps and motors. The power plant of the company is located in Mono County in the Sierra Nevadas.

BOULDER, COL.—It is said that work will be resumed on several old properties in Boulder County when the transmission lines of the Central Colorado Power Company are extended to some of the outlying districts and when the milling plants now under construction or being remodeled are completed. The Blue Bird Mines Company is making arrangements to open its mines. The Utica and Gage mines in the Ward section are awaiting the completion of the transmission line to resume work. The Central Colorado Power Company is extending its lines from the Frigid Mine, near Crisman, to furnish electricity to operate the compressor plant. The Pollock Mill, at Salina, is being overhauled and will soon be placed in operation. A large electric motor is being installed in the Wolf Tongue mill, at Nederland, to supplement the water-power plant.

DENVER, COL.—The Denver & Interurban Railroad Company, which operates an electric interurban railway between Denver and Boulder, forty-six miles in length, is contemplating extending the service beyond Boulder to Longmont, Loveland, Fort Collins and Greeley. Ultimately electric locomotives will be used and freight will be handled by electricity. Energy for operating its system is supplied by the Northern Colorado Power Company.

BROOKLYN, CONN.—The construction of an electric railway to connect Brooklyn, Danielson, Willimantic, Attawaugan and Ballouville is reported to be under consideration. William Clewley, of Brooklyn, is interested in the project.

NEW HAVEN, CONN.—The Shore Line Electric Railway Company is reported to be contemplating the installation of a 300-kw rotary converter at its power house in Waterford. It is understood that the company is planning to supply electricity to the New London & East Lyme Street Railway.

WATERBURY, CONN.—Application has been made to the Council by the Connecticut Company for a franchise to build several extensions to its railway system in Waterbury.

WASHINGTON, D. C.—The Bankers' Electric Protective Association, of Boston, Mass., has been awarded the contract for installing electric linings for certain vaults in the Treasury Department, Washington, D. C.

WASHINGTON, D. C.—Plans are being considered by the Capital Traction Company for the construction of a power house on Thirty-sixth Street and M Street, in Washington. The building will be of brick and concrete construction, one story high.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 14, for furnishing and installing lighting fixtures in the United States buildings at Beatrice, Neb.; Clifton Forge, Va.; Jackson, Mich.; Belfast, Maine; Bristol, Tenn.; La Crosse, Wis.; Moscow, Idaho; Owensboro, Ky., and San Angelo, Tex., in accordance with plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

ATLANTA, GA.—The Georgia Power Company, which has secured permission from the State Railroad Commission to issue $10,000,000 in capital stock and bonds to the amount of $10,000,000, will absorb the plants and holdings of the North Georgia Electric Company, the Etowah Power Company and other power plants and sites at Dunlap, Buford, Newnan and Tallulah, giving it practically the control of all the water power of the Tallulah, Chattahoochee and Etowah rivers. It is understood that the Georgia Power Company is controlled by the Westinghouse Electric & Manufacturing Company interests. The company has entered into a contract with the Northern Construction Company, of Detroit, Mich., for the development of the acquired holdings. The cost of the work is estimated at about $11,000,000. About 101,000 hp will ultimately be developed. For further information address C. Elmer Smith, of York, Pa.

CAIRO, GA.—The contract for improvements to the municipal electric light plant has been awarded to J. B. McCrary & Company, of Atlanta, Ga. The cost of the work is estimated at about $15,000.

GRIFFIN, GA.—The Central Georgia Power Company is reported to have offered to furnish electricity for an electric sign to be erected on top of the new hotel. The offer has been accepted by the City Council.

WAYCROSS, GA.—The Southern Bell Telephone & Telegraph Company is contemplating extensive improvements to its local system, including the erection of a new exchange building and the installation

of a new switchboard. The cost of the improvements is estimated at $50,000.

WRIGHTSVILLE, GA.—Preliminary arrangements are being made for the construction of an electric railway from Wrightsville to Lyons.

DECATUR, ILL.—Powers Brothers are reported to be contemplating the installation of a new 150-hp boiler in the power plant of the Powers Block.

DE KALB, ILL.—The Exchange Telephone Company has applied to the City Council for a franchise to erect and operate telephone lines in De Kalb.

MARSEILLES, ILL.—Preparations are being made by the Western Railway & Light Company to begin work on the construction of a new hydroelectric power plant at Marseilles, which will involve an expenditure of about $300,000. The proposed plant will supply electricity throughout this section of the Illinois River Valley.

MATTOON, ILL.—It is understood that the Decatur, Sullivan & Mattoon Traction Company will begin work on construction of its proposed electric railway, forty-eight miles in length, early in the spring. J. A. McFall, of Mattoon, Ill., is secretary of the company.

MOLINE, ILL.—The People's Power Company of Moline, Ill., has entered into a contract to supply electricity to six allied manufacturing companies in Moline and East Moline, as follows: Deere & Company, Deere & Mansur Company, the Moline Wagon Company, the Velie Motor Company, the Union Malleable Company and the Marseilles Company.

MOLINE, ILL.—Plans are being considered by the farmers on the Rock River bottoms to drain several acres of land by means of electrically operated pumps at stations located on the dikes along the river banks. It is stated that H. Arp, one of the parties interested in the project, proposes to utilize electricity for plowing, replacing gasoline motors.

PEORIA, ILL.—The Union Brewing Company is reported to be contemplating changing the motive power of its large brewing plant from steam to electricity.

STANDARD, P. O. GRANVILLE, ILL.—The Berry Coal Company, it is stated, is equipping its mines for electrical operation, energy for which will be furnished from the plant at Granville. Electricity for lighting the village is also supplied from the Granville plant.

ANDERSON, IND.—The City Council has decided to abolish all flat rates and install an exclusive meter service beginning with Jan. 1, 1911, for both the water and electric light service.

BEECH GROVE, IND.—It is reported that the Beech Grove Traction Company is planning to construct a substation on Twenty-fifth Street and Churchman Avenue, in Beech Grove. The building will be 26 ft. x 34 ft., and will be equipped with motor generators, supplied by Fairbanks, Morse & Company. Arrangements have been made by the company to secure power from the Indianapolis Light & Heat Company, of Indianapolis, Ind.

MUNCIE, IND.—The Delaware & Madison Counties Telephone Company is contemplating improvements to its local system and erection of additional toll lines, which will involve an expenditure of about $25,000. New toll lines will be built to Newcastle, Gaston, Alexandra and other cities.

NEWCASTLE, IND.—It is reported that improvements to the municipal electric light plant and water works system are under consideration.

NEWCASTLE, IND.—R. R. Faulkner, principal owner of the Newcastle Independent Telephone Company, has sold his interests to the Eastern Telephone Company, of Winchester. The new owners, it is said, will make improvements to the local system, including the erection of additional toll lines direct to Muncie and Winchester.

ATLANTIC, IA.—At an election to be held Dec. 5 the proposition to issue $5,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant, will be submitted to a vote.

CENTERVILLE, IA.—Plans are being considered for the installation of electroliers for the public square. G. M. Barnett is chairman of the committee.

EMMETSBURG, IA.—The farmers of Great Oaks Township have organized a mutual telephone company.

LINEVILLE, IA.—The Iowa Telephone Company has applied for a franchise to install a long distance telephone exchange station.

LORIMOR, IA.—The farmers in this vicinity are organizing a company for the purpose of installing a telephone system.

MASENA, IA.—The Masena Telephone Company is reported to be contemplating improvements to its system.

MUSCATINE, IA.—The Vienna Pearl Button Company is erecting a large addition to its plant. An electric power plant will be installed to furnish electricity to operate the machinery.

OSKALOOSA, IA.—The local telephone exchange has been taken over by a new company which, it is said, will make extensive improvements to the system, involving an expenditure of about $25,000.

OSKALOOSA, IA.—Surveys have been completed by the Iowa Traction Company for its proposed electric railway from Oskaloosa to Tama, a distance of sixty-five miles. The project has been financed and it is understood that contracts for construction of the road will be awarded within sixty days. George E. Woodhouse is president.

ROCKFORD, IA.—The Cartersville and Rudd Mutual Telephone Companies have applied to the Town Council for a franchise to establish exchanges in this town.

McPHERSON, KAN.—Bonds to the amount of $7,000 have been voted for improvements to the municipal electric light plant in McPherson.

PARSONS, KAN.—The proposition to issue $50,000 in bonds for the construction of a municipal electric light plant in Parsons, Kan., has been abandoned.

SYLVIA, KAN.—The City of Sylvia has decided to purchase the local electric light plant, owned by B. McKeown, which was burned out some time ago. Bonds to the amount of $6,000 have been voted, of which the proceeds of $2,000 will be used to purchase the property and $4,000 for site for power house and a new engine.

BOWLING GREEN, KY.—The Kentucky Rock Asphalt & Coal Company, recently incorporated, proposes to erect a rock asphalt plant with an output of 200 tons daily, and also contemplates building a by-product plant for extraction of liquid asphalt. Equipment required for the plant will include engines, boilers, pump, rock crushers, rolls, electrical machinery, etc. B. F. Gardner is president, and M. H. Crump, vice-president, both of Bowling Green, Ky.

DANVILLE, KY.—Preparations are being made by Louis Herrington and H. Dean, both of Richmond, Ky., to develop the water power of Dix River. The present plans call for the construction of a dam near Danville. It is proposed to supply electricity in Danville, Harrodsburg, Nicholsville, Lancaster, and other cities.

VINE GROVE, KY.—It is reported that W. A. Burkhart, owner of the Vine Grove Milling Company, is contemplating the installation of an electric plant to supply electricity for lamps in Vine Grove.

PORTLAND, MAINE.—The Consolidated Electric Light Company has commenced work on the construction of its proposed new power plant at Bonny Eagle, on the Saco River. The initial installation will develop 6000 hp.

BALTIMORE, MD.—Sealed bids will be received by the Board of Awards, Baltimore, Md., until Nov. 30 for construction of office and laboratory building and transformer house at the Back River sewage disposal works. Plans and specifications can be secured upon application to the Sewage Commission, Room 904 American Building, Baltimore, Md., for which a deposit of $10 will be required, which will be refunded upon return of the plans. Calvin W. Hendrick is chief engineer of the sewerage commission.

ASSONET, MASS.—A new electric light plant is being installed at the gun factory of W. R. Davis & Sons.

BOSTON, MASS.—The New York, New Haven & Hartford Railroad Company has petitioned for legislation granting it permission to acquire, double track and equip for the electrical operation the Boston, Revere Beach & Lynn Railroad. The proposition involves an expenditure of about $15,000,000.

BRIDGEWATER, MASS.—A new dormitory is being erected on Grove Street, to be used in connection with the State Normal School, in Bridgewater. An appropriation of $175,000 was made by the Legislature last spring, which will provide for a new power plant as well as the dormitory. The plant will supply electricity for lighting and steam heat for the building.

GRANITEVILLE, MASS.—The Lowell Electric Light Corporation is extending its transmission line to Graniteville for the purpose of supplying electricity for lamps and motors to the machine shop of the C. G. Sargeant Sons Corporation. It is expected that other residents will utilize the service in the near future.

NORTHFIELD, MASS.—The electric light committee has entered into a contract with the Greenfield Electric Light & Power Company, of Greenfield, Mass., for lighting the streets of Greenfield. Electricity for operating the system will be transmitted from the plant at Greenfield. A twenty-four hour service will be established for both lamps and motors. It is expected that the company will furnish commercial service in West Northfield and South Vernon.

STERLING, MASS.—At a special town meeting, to be held Nov. 26, the proposition to install an electric light system, the cost not to exceed $8,000, will be submitted to a vote.

WORCESTER, MASS.—A committee has been appointed by Worcester Merchants' Association to make a tour of several large cities for the purpose of investigating the street lighting systems with a view of enabling the association to recommend a new system for lighting the streets of Worcester. The committee consists of Edwin E. Dodge, president; William A. Lytle, chairman on lighting, and John P. Coghlin. The committee will be accompanied by Henry A. Knight, superintendent of lights, who will represent the city, and Fred H. Smith, assistant superintendent, representing the Worcester Electric Light Company.

GRAND LEDGE, MICH.—The Commonwealth Power Company is reconstructing its entire street lighting system in Grand Ledge. An ornamental lighting system is to be put in.

OLIVET, MICH.—E. M. Arnos, manager of the proposed electric light company, writes that bids will be received until Nov. 25 for construction of its electric light plant, to cost from $10,000 to $15,000. Dr. J. C. Shedd, of Olivett, Mich., is consulting engineer.

MANISTEE, MICH.—Plans are being prepared by Daniel J. Albertson, of Kalamazoo, Mich., for a hydroelectric system for the Manistee County Electric Company, work on which will probably begin in the

spring. A large steam auxiliary steam power plant will probably be erected in Manistee. For further information address the Manistee County Electric Company, care of Clyde J. Homes, 256 Houseman Building, Grand Rapids, Mich.

MUSKEGON, MICH.—It is reported that Vandervest & Peas, Montgomery Building, Muskegon, Mich., are receiving bids for the construction of a new municipal electric light plant for the City of Muskegon, to cost about $75,000.

BLOOMING PRAIRIE, MINN.—Plans are being considered by the Blooming Prairie Farmers & Merchants' Telephone Company for the erection of a new telephone exchange. The company has purchased the telephone system of the Steele County Telephone Company and proposes to make extensions to the various lines.

CROSBY, MINN.—The Deerwood-Aitkin Telephone Company is reported to be contemplating the erection of a telephone line to Ironton, Minn.

DASSEL, MINN.—The installation of an electric light system in Dassel is reported to be under consideration.

DEERWOOD, MINN.—M. D. Storer, of Bemidji, Minn., has been granted a franchise by the Council to install an electric light plant in Deerwood.

HIBBING, MINN.—Preparations are being made by the Mesaba Electric Railway Company for the construction of an electric railway from Hibbing to Gilbert, thirty-six miles in length. The cost of the proposed railway is estimated at $1,000,000. The company has been granted a franchise by the Board of County Commissioners of St. Louis County.

MINNEAPOLIS, MINN.—The Park Board of Commissioners has granted the Northwestern Telephone Company permission to lay conduits in the Lake Harriet district.

WORTHINGTON, MINN.—The local telephone company is reported to be contemplating the installation of a new switchboard.

OSYKA, MISS.—Contracts have been awarded for machinery and materials for the municipal electric light plant and water works system, as follows: For tank and tower to the Memphis Steel Construction Company, Henry R. Worthington, pumps; Walsh & Weidner, boilers; Walter Castenado, engine; electrical apparatus to the Fort Wayne Electric Works and to the Interstate Electric Company for supplies. The construction work will be done by day labor under the supervision of Xavier A. Kramer, engineer, of Magnolia, Miss.

CAINSVILLE, MO.—The installation of an electric light plant in Cainsville is reported to be under consideration.

COLUMBIA, MO.—The Council has appointed Prof. H. B. Shaw, dean of the school of engineering of the University of Missouri, as consulting engineer, in connection with the reconstruction of the municipal electric light plant and water works system in Columbia.

KANSAS CITY, MO.—Preparations are being made by the Kansas & Missouri Railway Company to begin work on construction of its proposed electric railway to connect Fort Scott and Pittsburg, Kan., and intervening cities, thirty-seven miles in length, in the spring. L. H. Phillips, 610 Broadway, Kansas City, Mo., is president.

KANSAS CITY, MO.—Bids will be received by the Board of Fire and Water Commissioners, City Hall, Kansas City, Mo., until Nov. 25, for furnishing the Water Department of Kansas City and erecting at the Turkey Creek station the following machinery: One side-crank automatic cut-off steam engine, one 50-kw, 220-volt generator, with switchboard and equipment. Plans and specifications may be seen at the office of the superintendent of water works. E. B. Harrington is secretary.

MARIONVILLE, MO.—The installation of a municipal electric power and pumping plant in Marionville is reported to be under consideration.

LIBBY, MONT.—E. K. Barnum and P. D. Pratt, of Libby, Mont., are reported to have been granted franchises to install and operate electric light plant, water works and telephone systems in this city. The cost of the proposed plants is estimated at about $100,000.

MISSOULA, MONT.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washingon, D. C., until Dec. 27, for construction, including plumbing, gas piping, heating apparatus, electrict conduits and wiring, of the United States post office building in Missoula, Mont., in accordance with plans and specifications, copies of which may be obtained from the above office or from the custodian of site at Missoula, Mont. James Knox Taylor is supervising architect.

GRAND ISLAND, NEB.—The City Council is contemplating improvements and extensions to the municipal electric light plant, plans for which have been prepared by W. K. Palmer & Company, of Kansas City, Mo., engineers.

ALLENTOWN, N. J.—The contract for construction of the proposed municipal electric light plant has been awarded to the Adams Electric Company, of Trenton, N. J. The cost of the plant is estimated at $40,000. W. W. Young, 220 Broadway, New York., is engineer.

BLOOMFIELD, N. J.—The Town Council has authorized the lighting committee, of which James M. Walker is chairman, to take steps toward securing legislation that will enable the town of Bloomfield to own and operate an electric light plant. The present contract with the Public Service Corporation of New Jersey will expire in February, 1911.

BURLINGTON, N. J.—The Board of Public Utility Commissioners has approved the ordinance of the City of Burlington granting a franchise to the Burlington Electric Light & Power Company for a term of fifty years. This franchise was originally passed by the City Council and vetoed by the Mayor and passed over his veto.

MORRISTOWN, N. J.—The Board of Freeholders of Morris County has granted the Morris County Traction Company permission to extend its railway on the county roads around the park and down Morris Street.

PITMAN GROVE, N. J.—The Board of Public Utility Commissioners has approved ordinances of the townships of Glassboro, Woolwich and Washington, granting franchises to the Gloucester Electric Company, of Pitman Grove.

WHITEHOUSE, N. J.—The question of establishing an electric power plant to supply electricity to the towns of Whitehouse, White Station, Lebanon and Annandale is under consideration.

ALAMOGORDO, N. M.—The Alamogordo Improvement Company, which is constructing a hydroelectric plant in Box Canyon, near Alamogordo, at a cost of $60,000, contemplates the erection of a series of power plants in that region for the purpose of supplying electricity for the towns and industries in that section.

SANTA FE, N. M.—Vernon L. Sullivan, Territorial Engineer, has approved the application of Messrs. Boulware and Johnson, of Silver City, N. M., for appropriation of 100 cu. second ft. of water in the upper Gila River, to be utilized for generating electricity. It is estimated that 3689 hp can be developed at a cost of about $1,200,000. The proposed plant will supply power to the Mogollon mining district. The work will include the construction of a dam 80 ft. long and 29 ft. high and a pipe line twelve miles in length. The project is reported to have been financed by the Baldwin Locomotive Works, of Philadelphia, Pa.

BALLSTON SPA, N. Y.—The Village Trustees have granted the Schenectady Railway Company, of Schenectady, N. Y., and Hudson Valley Railway Company, of Glens Falls, N. Y., permission to lay tracks through the village to connect the two roads.

BUFFALO, N. Y.—It is reported that bids are being received by the Larkin Company, 663 Seneca Street, Buffalo, N. Y., soap manufacturers, for a 2000-hp electric power plant, steam heating plant and elevator equipment for an eight-story building. Electricity for operating the plant will be secured from one of the Niagara Falls plants. Equipment required will include alternating-current motors, from 5 to 50 hp, transformers, switchboards, ammeters, etc. John D. Larkin is president.

HANNIBAL, N. Y.—The Public Service Commission has granted William Stock permission to transfer certain property rights and franchises to the Hannibal Electric Company; also a franchise held by him in the towns of Granby and Hannibal and the village of Hannibal. The Hannibal Electric Company has received authority to transfer its franchises in the towns of Granby and Hannibal and the village of Hannibal to the Oswego River Power Transmission Company.

HIGHLAND MILLS, N. Y.—The establishment of a lighting district in Highland Mills is under consideration by the Town Board.

ILION, N. Y.—The Board of Electric Light Commissioners has decided to replace the present arc lamps with tungsten lamps throughout the village. One of the reasons for changing the lighting system was the lack of power at the power station, making it necessary to change the street lighting system or to install an additional engine.

ISLIP, N. Y.—The Public Service Commision, Second District, has authorized the Islip Electric Light Company to issue $30,000 in capital stock and bonds to the amount of $20,000, the proceeds to be used for improvements and extension to its plant at Islip, N. Y.

NEW YORK, N. Y.—The Bronx Gas & Electric Company has applied to the Public Service Commission, First District, for permission to issue $153,000 in bonds, the proceeds to be used for extensions and improvements to its plant.

NEW YORK, N Y.—Sealed bids will be received by Kingsley L. Martin, Commissioner of Bridges, until Nov. 25, for electrical and ornamental work, elevators, stairs, drainage and anchor piers of the Queensboro Bridge over the East River, between the Boroughs of Manhattan and Queens.

NEW YORK, N. Y.—Bids will be received by the Board of Health, Department of Health, Fifty-fifth Street and Sixth Avenue, New York, N. Y., until Dec. 1, for furnishing and installing new gas piping and lighting fixtures in two tuberculosis clinics, one day camp and one department stable in the Boroughs of Manhattan and the Bronx. Blank forms and further information may be obtained at the office of the chief clerk, Department of Health. Ernest J. Lederle, Ph. D., is president.

OSWEGO, N. Y.—The Oswego street railway system is now operated by Niagara Falls power. The new substation in Oswego has been completed, which will be used in connection with the extension of the Syracuse, Lakeshore & Northern Railroad from Fulton to Oswego. The extension will not be in operation until next year. The substation is connected up with the high-tension wires at Fulton. The local street railway system is owned by the Syracuse, Lakeshore & Northern Railway Company. The People's Gas & Electric Company has supplied electricity for operating the local railway system in the past.

SENECA FALLS, N. Y.—Plans have been adopted by the Village Board and the Geneva-Seneca Electric Company for installing a new street lighting system in the business district of Seneca Falls. Under

the terms of the agreement the company will erect twenty-one ornamental posts, each carrying five lamps.

WATERFORD, N. Y.—Nichols Steenburgh, of Crescent, N. Y., is reported to be interested in a project to construct an electric railway from Waterford, N. Y., along the bank of the Mohawk River, through the towns of Halfmoon, Crescent and Vischer Ferry. The cost of the proposed railway is estimated at from $150,000 to $200,000.

ASHEVILLE, N. C.—The Asheville Electric Company has awarded the contract for the construction of certain extensions of its transmission lines in Asheville to B. J. Luther & Company, of Baltimore, N. C. The company contemplates erecting several miles of extension to its lines in West Asheville, contracts for which will be let later.

ASHEVILLE, N. C.—The North Carolina Electrical Power Company has filed a mortgage in favor of the Wachovia Loan & Trust Company, of Asheville, N. C., as trustee, to secure an issue of $2,000,000 in bonds. The North Carolina Electrical Company recently took over the property of the W. T. Weaver Power Company, assuming the entire bonded indebtedness, amounting to about $225,000. The company is to issue refunding bonds to take up all bonds of both companies and also to secure funds for further extensions and improvements to the plants it controls.

GRAHAM, N. C.—The River Falls Cotton Mills Company is planning to erect its proposed plant, contracts for which were awarded some time ago. It will be equipped with 10,000 spindles and 240 looms. A hydroelectric power plant will supply electricity for lighting and operating the mill.

HENDERSONVILLE, N. C.—It is reported that contracts have been awarded for the construction of the proposed Gastonia, Hendersonville & Asheville Interurban Railway. Work on construction of the road will begin soon.

HIGH POINT, N. C.—The City Council is considering the question of issuing $100,000 in bonds, the proceeds to be used for the installation of a municipal electric light plant and other public improvements.

WARRENTON, N. C.—The installation of a municipal electric light plant in Warrenton, N. C., is reported to be under consideration. J. H. Bridgers, of Henderson, N. C., is consulting engineer.

BERTHOLD, N. D.—John I. Moore has been granted a franchise to install an electric light plant in Berthold, N. D.

BARBERTON, OHIO.—The City Council has refused to grant a franchise to George W. St. John and L. M. Clifford to operate an electric light system in Barberton. The Northern Ohio Traction & Light Company, of Akron, Ohio, now supplies the electrical service in this town.

CLEVELAND, OHIO.—The Sabin-Curtis Machine Company is reported to be in the market for electric motors for its new shop now being erected at 6536 Carnegie Avenue, Cleveland.

CLEVELAND, OHIO.—A new company has been organized by the parties interested in the Cleveland Foundry Company under the name of the Cleveland Metals Products Company, capitalized at $200,000. The company has purchased a site of sixteen acres at Callamer Avenue and the Nickel Plate Railroad, and will erect at once two buildings, one 60 ft. x 170 ft., two stories high, which will be used as a press shop, and the other 80 ft. x 200 ft., one story, for an enameling shop. The company will do the enameling required by the Cleveland Foundry Company and will bring out a line of metal stamping, including lamp shades, outdoor lamps, railroad signals and other products. The plant will be operated by electricity, which will be purchased from a commercial company.

COLDWATER, OHIO.—Rapid progress is being made on the construction of the new plant of the New Idea Spreader Company, of Coldwater, Ohio. The buildings now under construction have an approximate floor space of 100,000 sq. ft. It is understood that plans are being made for the erection of several other buildings next spring. The entire plant will be equipped for electric motor drive, electricity for which will be supplied by the company's own plant.

COLUMBUS, OHIO.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 5, for the installation of a vacuum cleaning system in the United States post office and court house at Columbus, Ohio, in accordance with plans and specifications, copies of which can be obtained at the above office, or of the superintendent at Columbus, Ohio. James Knox Taylor is Supervising Architect.

DEFIANCE, OHIO.—The City Council has authorized the Director of Public Works to enter into a contract with the Defiance Gas & Electric Company for street lighting at the rate of $70 per lamp per year. The rate for electricity for commercial lighting is to be 9 cents per kw-hour, with a discount of 10 per cent if paid before the tenth of the month. The price for gas is $1.35 per 1000 cu. ft., with a discount of 10 per cent.

EMPIRE, OHIO.—The Union Clay Manufacturing Company has awarded the contract for the electrical work for its entire plant to the Risinger Manufacturing Company, of East Liverpool, Ohio. The work will include power apparatus, motor generator set, electrical mine equipment and lighting the plant and office buildings.

MT. GILEAD, OHIO.—Preliminary plans are being prepared by the General Traction Development Company for the construction of an electric railway from Mt. Gilead to Delaware, Ohio. George L. Bittinger, 516 Hippodrome Building, Cleveland, Ohio, is president of the company.

POLAND, OHIO.—John McClure is reported to be interested in a project to construct an electric railway from Poland to Boardman, and there to connect with the Youngstown & Southern lines.

FAIRVIEW, OKLA.—It is reported that the city will soon ask for bids for equipment for the extension to the municipal electric light plant. D. H. Denman is Mayor.

FORT SILL, OKLA.—Sealed proposals will be received at the office of the constructing quartermaster, Fort Sill, Okla., until Dec. 15 for furnishing and installing a cold storage and ice plant in the power house at new artillery post, at Fort Sill, Okla. Plans and specifications can be obtained upon application, for which a deposit of five dollars will be required, which will be refunded upon return of plans. Captain David L. Stone is constructing quartermaster.

MUSKOGEE, OKLA.—The Muskogee Industrial Development Company, of Muskogee, Okla., has increased its capital stock from $250,000 to $300,000. The company was organized to erect a hydroelectric plant on the Grand River.

PORTLAND, ORE.—The Alameda Improvement Association has been organized by the property owners in Alameda Park and Olmstead Park for the purpose of securing electric lighting, telephone and mail service in that district. L. O. Roberts is a member of the committee.

EDDYSTONE, PA.—I. T. Silverman, of Philadelphia, Pa., is reported to be interested in a project to construct a new electric railway to extend from Eddystone to the old rifle range in Tinicum township, from which point it will branch across the marsh lands to West Philadelphia.

EVANS CITY, PA.—Arrangements are being made by the Allegheny & Northwestern Railway Company for the construction of an electric railway from Evans City to Harmarville, a distance of twenty-four miles, bids for construction of which have been asked. The cost of the proposed railway is estimated at about $400,000. J. G. McPherson, of Philadelphia, Pa., is president.

HAZLETON, PA.—The Markle coal interests are reported to be interested in the organization of four companies which propose to furnish electricity in Hazleton and three adjoining townships, for which charters have already been obtained. The incorporators are: C. B. Houck, A. Markle and W. H. Lawall, all of Hazleton, Pa.

LANCASTER, PA.—The Canestoga Portland Cement Company is reported to be considering the construction of a large Portland cement plant, which will be equipped for electric motor drive. A large electric power plant will also be installed.

PHILADELPHIA, PA.—Arrangements are being made by the Philadelphia & Suburban Elevated Railroad Company for the extension of its proposed Broad Street subway and elevated system to Olney, by means of a loop from Lehigh Avenue and Broad Street, passing through Kensington and Frankford to Wayne Junction.

PHILADELPHIA, PA.—The Manayunk power station of the Philadelphia Hydro-Electric Company has been completed. The new plant was erected at a cost of about $150,000 and will have an output of about 6000 hp. The company will supply electricity to the Philadelphia Rapid Transit Company and the Philadelphia Electric Company.

PITTSBURGH, PA.—The contract for the construction of the new power plant of the American Locomotive Works for its works on the lower North Side, has been awarded to the Cuthbert Railway Company, for $25,000. It is proposed to equip the locomotive works for electrical operation.

READING, PA.—The Metropolitan Electric Company, of Reading, Pa., it is reported, will discontinue service from its hydroelectric power at Klapperthal, near Reading, as soon as its new plant in this city is completed. It is understood that the company is contemplating rebuilding the Klapperthal plant.

SHARPSBURG, PA.—The contract for furnishing and installing two 300-hp boilers, feed-water heater, feed pump and necessary piping at the municipal light and water plant has been awarded to the Oil City Boiler Works, of Oil City, Pa., for $9,353. Albert F. Young is borough clerk.

WILLIAMSON, PA.—The Williamson Rural Telephone Company, recently organized, is planning to erect a telephone line from Williamson to Upton, connecting there with the belt line to the Greencastle exchange. J. W. Barnhart is president.

NEWPORT, R. I.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 29, for furnishing and installing at the naval training and torpedo stations, Newport, R. I., generator sets as per schedule No. 3051. Blank proposals will be furnished upon application to the navy pay office, Newport, R. I., or at the above office. Applications for proposals should designate the schedule desired by number.

CAMDEN, S. C.—The contract for installing the electric lighting equipment in the Hermitage Cotton Mills has been awarded to the Ideal Electric Company of Charlotte, N. C. About 500 lamps will be required.

GREENVILLE, S. C.—It is stated that the Greenville, Spartanburg & Anderson Electric Railway Company will award contracts for the construction of the proposed railway from Greenville to Belton, S. C., and for building the line northward to Mount Holly, N. C., simultaneously; the last-named road will be 110 miles in length. W. E. Lee is chief engineer.

ROCK HILL, S. C.—T. E. Cothran, electrical engineer, engaged by

the Town Council to make investigations and place a value on the plant of the Rock Hill Water & Electric Company, has submitted his report to the Council. In the report the value of the plant is given at about $92,000, including the recent improvements made at a cost of $22,000. It is said that the Board of Public Works has recommended to the Town Council that authority be granted the Board of Public Works to make an offer of approximately $100,000 for the purchase of the plant, and that if the offer is not accepted without delay the Council instruct the Board of Public Works to proceed with the construction of a municipal electric and water plant.

ALPENA, S. D.—The Missouri Valley Northern Railway Company is reported to be planning the construction of an electric railway from Chamberlain to Huron, for which surveys are now being made.

HOWARD, S. D.—C. A. Laurson has awarded the contract for the construction of an electric light plant in Howard to Harry Lyon, of Sioux City, Ia.

JOHNSON CITY, TENN.—A contract has been awarded by the Watauga Electric Company for the installation of a 500-kw steam turbine. A. Smith is secretary and manager.

MARBLE FALLS, TEX.—Preliminary steps have been taken by E. C. Alexander and associates, who are erecting a large concrete dam across the Colorado River and a 30,000-hp hydroelectric power in Marble Falls, for the erection of a transmission line extending from Marble Falls to Temple, which will also furnish electrical service to the towns of Taylor, Georgetown, Granger, Bartlett and Holland. It is also proposed to extend the lines to Austin, San Antonio, Llano and other towns.

PALACIOS, TEX.—It is reported that C. D. Deal, of Colorado Springs, Col., who recently purchased the local electric light and ice plants, is contemplating the installation of additional machinery.

BEAVER, UTAH.—Plans are being considered for the construction of an electric railway to connect Beaver and Milford, for which surveys are being made. M. T. Burgess is chief engineer.

BURLINGTON, VT.—It is understood that the committee appointed to make investigations in connection with improvements to the municipal electric light plant will recommend an appropriation of $30,000 for new equipment for the plant.

BRISTOL, VA.—The construction of an electric railway from Bristol, Va., to Kingsport, Tenn., is reported to be under consideration.

CHASE CITY, VA.—The City Council has engaged J. Kent White, of Waynesboro, Va to prepare plans and specifications for an electric light plant and water-works system, to cost approximately $20,000.

MARTINSVILLE, VA.—At an election to be held Dec. 8 the proposition to issue $35,000 in bonds, the proceeds to be used for enlarging the municipal electric light plant, will be submitted to a vote.

NATIONAL SOLDIERS' HOME, VA.—Sealed proposals will be received at the office of the treasurer, southern branch of National Home for Disabled Volunteer Soldiers, National Soldiers' Home, Va., until Dec. 12, for furnishing and installing fixtures for hospital, installing electric motor in machine shop and repairs to quarters of surgeon and quartermaster. Plans and specifications can be secured upon application to John T. Hume, treasurer.

CHEHALIS, WASH.—The City Council has passed a resolution providing for the installation of cluster lamps in the business district of the city, the cost of which is estimated at $15,000.

NORTH YAKIMA, WASH.—The contract for lighting Naches Avenue has been awarded to the Pacific Light & Power Company. It is understood that an ornamental lighting system will be installed. The Pacific Power & Lighting Company is reported to be preparing plans to enlarge the old power station at Fruitvale. The power house will be enlarged and additional machinery installed.

SPOKANE, WASH.—The National Power Company, of Spokane, Wash., is planning to construct a large plant at Dishman, a few miles east of Spokane. A number of buildings are to be erected and a large amount of machinery installed by the first of the year. The cost of the plant is estimated at $40,000.

WALLA WALLA, WASH.—Preparations are being made by the Pacific Power & Light Company for the erection of a transmission line from Walla Walla into the Freewater country in Oregon to supply electricity to pump water to irrigate 11,000 acres of land. A. S. Grenier is manager.

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light & Power Company has been granted permission by the Wisconsin Railroad Commission to issue $100,000 in bonds, the proceeds to be used to complete the dam and power house at Cedar Falls, to acquire additional riparian rights and to pay for additions, including the transmission line from Eau Claire to Chippewa Falls; also to pay the floating debt incurred for additions.

KENOSHA, WIS.—Plans are being prepared by the Kenosha Electric Railway Company for the construction of a branch from Middle Street Kenosha, to Washington Island.

LA CROSSE, WIS.—At the election held Nov. 8 the proposition to issue $50,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant, was defeated.

MENASHA, WIS.—The question of making improvements and extensions to the municipal electric light plant is reported to be under consideration by the City Council. It is proposed to increase the output by 225 hp.

WINNIPEG, MAN, CAN.—Bids will be received by the chairman of Board of Control of Winnipeg, Man., until Dec. 15, for 500-kw motor generator sets, plans and specifications for which can be obtained at the office of Smith, Kerry & Chace, engineers, Carnegie Library Building, Winnipeg, or at their office in Toronto, Ont. M. Peterson is secretary.

BROCKVILLE, ONT., CAN.—The Hydro-Electric Power Commission has submitted to the Town Council rates for furnishing Niagara power to the town as follows: For 1000 hp, $49.34; 2000 hp, $32.48, and for 3000 hp, $27.83. The Council considered the rates too high and no further action was taken. The rate quoted to Prescott for 1000 hp was $21.74 and to Morrisburg, $17.83.

COBALT, ONT., CAN.—Work has commenced on the construction of a hydro-electric power plant on the Mattagamia River at Sandy Falls, in the Porcupine district, six miles from the Timmins mine. Contracts have been placed for generators having a rating of 3000 hp with the Canadian Westinghouse Company, Ltd., and for turbines to drive same with the S. Morgan Smith Company, of York, Pa. For further information address John B. Holden, Manning Arcade, Toronto, Ont.

DUNDAS, ONT., CAN.—The Town Council has entered into a contract with the Hydro-Electric Power Commission for 600 hp to operate the municipal electric system. No extra equipment will be required in Dundas, but a transmission line from the transformer station to the town, about one mile in length, will be erected. The Hamilton Cataract Power, Light & Power Company now furnishes the service.

NEW HAMBURG, ONT., CAN.—The power house of the municipal electric light plant is being enlarged to provide space 10r the installing of transformers to utilize the power from the system of the Hydro-Electric Power Commission.

NIAGARA FALLS, ONT., CAN.—Owing to the inefficiency of the present street lighting system, Manager Folger has recommended discarding the 100 open arc lamps now in use and providing for the installation of new system, using either arc or tungsten lamps, the cost of which is estimated at about $9,300.

OTTAWA, ONT., CAN.—Arrangements are being made by the Ottawa, Rideau Valley & Brockville Railway Company to begin work at once on the construction of its proposed railway to connect Ottawa and Brockville, a distance of sixty miles. Andrew Hayden is president.

OTTAWA, ONT., CAN.—The construction of an electric railway extending from Ottawa to Kingston is reported to be under consideration. A company is being formed to build the road. The directors are: R. McElroy, M. L. A. Crop; F. A. Henry, of Westboro; J. S. McCann, of Kingston, and E. P. McGrath, of Ottawa.

SEAFORTH, ONT., CAN.—The ratepayers have voted in favor of the by-law authorizing a contract with the Hydro-Electric Power Commission for 500 hp, at an estimated cost of $41.25 per year per hp.

TORONTO, ONT., CAN.—The Canadian National Exhibition Board has adopted a report recommending the expenditure of $10,000 for wiring the exhibition grounds. Percy MacKid is electrical engineer for the exhibition grounds.

WINDSOR, ONT., CAN.—The question of extending the transmission system of the Hydro-Electric Power Commission from St. Thomas, Ont., to Windsor, Ont., is being considered by the Hydro-Electric Power Commission and the Provincial Cabinet. The proposed extension would be more than 120 miles in length and would involve an expenditure of about $1,000,000. Other extensions are under consideration, the cost of which is estimated at about $1,000,000.

MONTREAL, QUE., CAN.—The contract between the City of Montreal and the Saraguay Electric & Water Company has finally been ratified by the Board of Control and sent to the Council. Under the contract seventy-five arc lamps are to be installed in Notre Dame de Grace Ward at $90 each per year. The municipality before becoming annexed to Montreal had contracted for 350 lamps, but the city refused to pay for so many. The company has agreed to install only seventy-five lamps at present, and as the ward becomes more thickly populated will add more lamps until the full number of the original contract are installed.

QUEBEC, QUE., CAN.—At a recent meeting of the finance committee of the City Council it was decided to grant the Dorchester Electric Company a franchise to enter the city from the south shore to supply electricity in Quebec. Under the terms of the franchise the company is to erect a plant at a cost of $200,000, and to supply electrical service at a maximum rate of 10 cts. per kw-hour.

SHERBROOKE, QUE., CAN.—The Sherbrooke Railway & Power Company has been granted permission by the Council of Ascot to erect transmission lines from its plant in Sherbrooke to the Capeton mines, a distance of eight miles.

CHIHUAHUA, MEX.—The Sierra Mining Company is planning to install a hydroelectric power plant at its mines in this State. Under the terms of the concession granted by the State government the plant must be in operation within eighteen months.

MEXICO CITY, MEX.—Plans are being prepared by the Compania Irrigadora de Santa Maria, recently organized, for the installation of a large hydroelectric power plant in the Jojutla district, State of Morelos. Electric transmission lines will be erected to industrial centers and plantations in that region. The company will also construct an extensive system on its own lands, using electricity to operate the pumps. Emilio Pardo is president of the company; Lt.-Col. Armando I. Santacruz, vice-president and treasurer, and Indalecio Sanchez Gavite, Jr., secretary.

PACHUCA, MEX.—The stockholders of the Compania Irrigadora de Luz y Fuerza del Estado, S. A., have voted to change the name of the company to the Compania de Luz y Fuerza de Pachuca, S. A. The following officers were elected: R. C. Brown, president; Emilio Pardo and Luis Riba y Cervantes, vice-presidents; E. D. Trowbridge, director general, and Antonio Pacheco, general manager.

New Industrial Companies.

THE A. C. CAMERON STEAM PUMPS WORKS, of Jersey City, N. J., has been incorporated with a capital stock of $1,000,000, by H. O. Coughlin, L. H. Gunther and J. R. Turner, of Jersey City, N. J. The company proposes to manufacture pumps, motors, engines, air compressors, etc.

THE CENTRAL ELECTRICAL LABORATORY COMPANY, of West Lebanon, N. H., has organized with a capital stock of $5,000. The company proposes to erect a laboratory and factory for the purpose of testing and repairing electric light and power meters; also for designing, manufacturing and dealing in electrical, scientific and mechanical instruments and devices of all kinds.

THE DUAL IMPULSE MOTORS COMPANY has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $100,000. The incorporators are: F. C. Tygard, of Pittsburgh, Pa.; W. A. Loegler and C. H. Abbott, of Mt. Oliver, Pa. The company proposes to acquire patents on the international combustion engine and to manufacture apparatus for same.

THE DUNLAP ENGINEERING OPERATING COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by D. C. Dunlap, O. F. Cole and W. Armstrong, of Chicago, Ill. The company proposes to do a general engineering and contracting business.

THE ELECTRIC SAW COMPANY has filed articles of incorporation under the laws of the State of New Jersey, with a capital stock of $300,000. The incorporators are: A. H. Phillips, J. H. Longstreet and J. R. Furey, of Philadelphia, Pa.

THE ELECTROTONE AUTO MUSIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 by A. G. Clark, M. Schoenfeld, G. Rockwell, Jr., of New York, N. Y. The company proposes to manufacture pianos, musical instruments and automatic instruments.

THE GOURLEY HYDRO-CARBON CONVERTER COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing hydro-carbon converters and other mechanical devices. The incorporators are: T. P. Gourley, of Brooklyn, N. Y.; W. J. Hamilton and S. T. Williams, of Plainfield, N. J.

THE GREATER INDIANAPOLIS INDUSTRIAL ASSOCIATION, of Indianapolis, Ind., has been incorporated with a capital stock of $25,000 by John N. Carey, Henry Janesen, S. G. Vancamp, J. C. Schaf, C. A. Bookwalter and L. A. Cox. The company proposes to purchase land adjacent to the City of Indianapolis and build an industrial suburb, establish a power plant and locate factories.

HUNT & McCREE, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000, for the purpose of manufacturing and dealing in mechanical and electrical appliances, etc. The incorporators are: E. J. Forhan, G. F. Martin and H. P. Jones, of New York, N. Y.

LATEY & SLATER, Inc., of New York, N. Y., has been incorporated by H. N. Latey, F. L. Booth, of New York, N. Y., and F. R. Slater, of Yonkers, N. Y. The company is capitalized at $50,000, and proposes to do a general consulting and construction engineering business, etc.

THE LEWEN SYSTEM CONSTRUCTION COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 to construct bridges, tunnels, tanks, railways, etc. The incorporators are: C. Kriser, of Brooklyn; H. L. Lewen and S. L. Baron, of New York, N. Y.

THE MADISON T. B. WASHINGTON COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by M. T. B. Washington, M. W. Gilbert, and J. S. Brown, Jr., of New York, N. Y. The company proposes to manufacture automobiles, machinery, electrical apparatus, etc.

THE PERFECT FIRELESS & ELECTRIC COOKER COMPANY, of Toledo, Ohio, has been chartered by Luther D. Smith, W. A. Humphrey, Charles F. Nighswander, Max C. Roth and E. R. Kirkendall. The company is capitalized at $50,000, and proposes to manufacture a fireless and electric cooker.

THE STROMBERG MOTOR DEVICES COMPANY, of Boston, Mass., has been incorporated with a capital stock of $2,000 by H. E. Coulter, Charles G. Bancroft and William F. Poole.

THE WARREN POWER SYSTEM, Inc., of Cape May, N. J., has been chartered with a capital stock of $2,000,000 to manufacture and deal in apparatus for moving machinery of all kinds. G. G. Steigler and H. W. Nock, of Wilmington, Del., are the incorporators.

Personal.

MR. R. M. SEARLE, vice-president of the Rochester Railway and Light Company, will address the Toronto N. E. L. A. section at its regular monthly meeting on Nov. 28.

MR. D. F. CRAWFORD, general superintendent of motive power of the Pennsylvania Railroad Company, is the author of an article entitled "Electric Car Lighting," in the November issue of the *Yale Scientific Monthly*.

PROF. D. S. JACOBUS, advisory engineer of the Babcock & Wilcox Company, delivered a lecture on Nov. 10 before the Franklin Institute on the "Generation of Power," which sketched the development of recent years in steam boilers and prime movers.

MR. C. M. CALDWELL has been appointed inspector of electric meters for Kansas City, Mo. Mr. H. Guy Porter, James Milliken University, class of 1907, is his deputy. Both were appointed as a result of a competitive examination under the civil service rules.

MR. L. B. MARKS delivered a lecture on "Factory Lighting" on Nov. 17 before the Manufacturers' Association of Bridgeport, Conn. On Nov. 28 Mr. Marks will lecture before the Brooklyn chapter of the American Institute of Architects on natural and artificial lighting of interiors.

MR. A. C. FROST, of Chicago, has announced his intention to retire from the presidency of the Chicago & Milwaukee Electric Railroad Company when the proposed reorganization is completed. The company is now in the hands of receivers, and it is expected that a reorganization will be effected within six months.

MR. WALTER BRINTON, superintendent since 1895 of the manganese-steel department of the Taylor Iron & Steel Company's plant at High Bridge, N. J., has resigned to become consulting engineer for the Edgar Allen American Manganese Steel Company, which is manufacturing manganese steel at Chicago Heights, Ill., and at New Castle, Del. Mr. Brinton's headquarters will be at the New Castle plant.

MR. J. H. VAIL, of New York, addressed the Toronto A. I. E. E. section at the Engineers' Club, on Friday, Nov. 18, on "The Electric Truck and Its Uses." Over one hundred lantern slides were used during the lecture, showing the electric tricycle of 1881, the car built for the Sultan of Turkey in 1888 and Mr. Fred M. Kimball's vehicle of 1888, as well as present and past commercial types of vehicles.

MR. FRANK G. BOLLES, commercial engineer of the Allis-Chalmers Company, has resigned in order to devote his entire attention to the Reliance Engineering & Equipment Company, Majestic Building, Milwaukee, in which he has an equal interest with Mr. C. A. Tupper and others. The company, which is taking on a number of additional exclusive agencies, will remove December 1 to offices in the new Engineering Building and considerably extend the scope of its operations.

MR. ALBERT SCHEIBLE has opened an office as research engineer at 125 La Salle Street, Chicago. Mr. Scheible is held in high esteem by the electrical men of Chicago, among whom he has a wide acquaintance. He was recently chairman of the Chicago Section of the Illuminating Engineering Society, and he is also an active member of the Western Society of Engineers. He has been a frequent contributor to the technical press. Mr. Scheible will devote attention to the investigation of both electrical and mechanical problems.

MR. W. S. LEE, chief engineer and general manager of the Southern Power Company, has returned from Europe, where he made a study of the processes used at several Continental plants for the electrical fixation of nitrogen for use in the manufacture of fertilizers. As a result, his company has recently purchased the rights for two processes that are used on the Continent, and Mr. Lee will have them investigated by the chemists and engineers of the Southern Power Company with a view to establishing one or more plants near to, or on the lines, of the several hydroelectric plants of the company.

MR. RALPH S. GAVITT, manager of the Leominster Electric Light & Power Company of Leominster, Mass., has tendered his resignation to the Massachusetts Lighting Companies of Boston, to take effect Jan. 1, 1911. After that date Mr. Gavitt will become superintendent of the Calgary Power Company, Ltd., of Calgary, Alta., Can. As stated in our issue of Oct. 20, this company has under construction on the Bow River a 19,500-hp hydroelectric station. Mr. Gavitt has been connected with the Massachusetts Lighting Company since his graduation from Williams College, three years ago.

Trade Publications.

SUBWAY BOXES.—Manhole boxes of the subway type are described and illustrated in Circular No. 114 of the D. & W. Fuse Company, Providence, R. I.

AUTOMOBILE LIGHTING.—Electric lighting outfits for automobiles and motor boats are illustrated, described and listed in a catalog issued by the Electric Storage Battery Company, Philadelphia, Pa.

PORTABLE DESK TELEPHONE.—The Stromberg-Carlson Telephone Manufacturing Company has issued Pamphlet No. 32, giving a brief outline of its portable desk telephone and flat-type metal bell box for use therewith.

ADJUSTABLE SPEED MOTORS.—The Reliance Electric & Engineering Company has issued an illustrated mailing folder devoted to its adjustable speed direct-current motors. These motors are of the variable-reluctance type.

LIGHTING FIXTURES.—The Western Electric Company has issued Bulletin No. 9635, devoted to fixtures designed particularly with reference to use with metallic-filament lamps. These fixtures are of both the folding and non-folding types.

BUSINESS NOTES.

J. R. DEANE & COMPANY, 46 Van Buren Street, Chicago, have been appointed agents in Cook County for the Independent Electric Manufacturing Company of Milwaukee, manufacturer of controlling devices.

THE FOX MULTAX ELECTRIC COMPANY, 126 Lafayette Street, New York, reports very active sales of its Fox-Multax Century flaming-arc lamps. Prominent among the recent contracts taken was one from the United States government.

THE METROPOLITAN ELECRIC MANUFACTURING COMPANY, formerly the Metropolitan Switchboard Company, has moved its offices and factory to Fourteenth Street and East Avenue, Long Island City, just the other side of the Fifty-ninth Street bridge.

THE GREGORY ELECTRIC COMPANY, of Chicago, Ill., reports an unusual demand for lighting apparatus, and has recently shipped a long list of direct and alternating current apparatus to different sections of the country. Among the apparatus was a carload of National 220-volt motors to the Creamery Package Manufacturing Company, of Lake Mills, Wis.

THE NOISELESS TYPEWRITER COMPANY, Middletown, Conn., and New York City, has recently completed the development of a noiseless typewriter which is now being put on the market. The special feature of this machine is that the typing is done by a pressure stroke instead of a blow. Hence the machine is practically noiseless and has a low maintenance cost. Less force is required to operate it and it gives a clearer impression than the ordinary machine. Moreover, the number of legible carbon copies which can be made by it is greatly multiplied. The president of the company is W. Caryl Ely, of Buffalo.

MESSRS. BRUCE, PEEBLES & COMPANY, LTD., of Edinburgh, have just secured an important order for sixteen Peebles 50-cycle, 6600-550-volt motor converters (La Cour patents) each of 475 kw capacity. The machines, which are for the Calcutta Electrical Supply Corporation, will convert from alternating to direct current or vice versa, and be used for supplying a three-wire direct-current network. Tenders were invited for induction and synchronous motor generators with permission to offer alternatives for rotary converter or motor converters. After an investigation by the consulting engineers, Messrs. Kennedy & Jenkin, of London, it was decided to place the contract with Bruce, Peebles & Company for the sum of £25,000.

THE DE LAVAL STEAM TURBINE COMPANY, Trenton, N. J., announces that the Dravo-Doyle Company, by which it has heretofore been represented in Pittsburgh, Philadelphia and Cleveland, will open a Chicago office in the Marquette Building, in charge of Mr. H. S. Budd. The Dravo-Doyle Company has been very successful in the introduction of De Laval steam turbines for high and low steam pressure, and for direct connection to electrical generators, centrifugal pumps, blowers, etc., and has a wide experience in the general engineering and installation work connected with this kind of machinery, as well as with De Laval centrifugal pumps, all classes of service, including boiler feeding, hydraulic pressure service, water works, etc.

RECORD CONCRETE LAYING BY ELECTRICITY AT GATUN LOCKS.—All hourly records for concrete laying were broken on Oct. 6, 1910, by the cableways used in constructing the great locks on the Panama Canal at Gatun. Lidgerwood cableways, equipped with electric power, are used for placing the concrete, the cableways being arranged in duplex form on four pairs of towers, 800 ft. apart. Of the pair of cableways that broke the record, strand A placed 49 cu. yd. in one hour, and strand B placed 50 cu. yd. during the same hour. This means that the carriage on each strand made 25 trips per hour. The cableways were sold under a guarantee that they would make twenty trips per hour. One operator controls the entire operation on each strand.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 14, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

975,399. STARTING MEANS FOR VAPOR RECTIFYING DEVICES; F. Conrad, Swissvale, Pa. App. filed Sept. 20, 1906. Particularly for mercury-vapor rectifiers which are started automatically by the direct current by means of an auxiliary terminal, in addition to positive and negative terminals, the starting means including inductively related primary and secondary circuits and a condenser and means for opening the primary circuit after the rectifying process has begun.

975,401. MAGNETO-ELECTRIC MACHINE; S. B. Daugherty and S. F. Johnson, Indianapolis, Ind. App. filed March 21, 1910. For igniters with improved frame construction, having opposite longitudinal portions with angular offsets joined together by a ring portion and a bearing plate.

975,404. ELECTRIC LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed March 15, 1909. A truck and propelling motor and skeleton cradle in which the motor is mounted with standards supported upon one of the main structural elements of the truck, the cradle being pivoted in the standards.

975,417. ELECTRIC CIRCUIT SWITCH; F. W. Harris, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Knife-blade switch whose contacts are rigidly mounted on insulating posts with insulating ribs for high-potential work.

975,418. ELECTRIC SWITCHING DEVICE; F. W. Harris, Wilkinsburg, Pa. App. filed March 9, 1908. High voltage mechanism including an electrically operated switch mounted on the top of a pole whose contact members are on porcelain insulators with a movable contact on the third insulator located between the two and rotatably mounted, so as to bridge or disconnect the fixed contacts and caused to rotate by a solenoid magnet.

975,419. ELECTRIC CIRCUIT SWITCH; F. W. Harris, Wilkinsburg, Pa. App. filed April 10, 1908. Stationary terminals with a horizontal bridging member, having a fusible element, which is suspended from the terminals by means of a linked hinge at one end and a catch at the other.

975,420. SYSTEM OF ELECTRIC CIRCUIT PROTECTION; F. W. Harris, Wilkinsburg, Pa. App. filed Jan. 21, 1909. An electromagnet for operating a circuit breaker, which magnet is connected directly to the high voltage line and is supported by one of the line insulators so that it is only necessary to insulate the magnet against the drop in its own windings, the magnet operating a relay switch through a long insulating bar or acting upon the tripping mechanism of an automatic circuit breaker.

975,421. CIRCUIT BREAKER; F. W. Harris, Wilkinsburg, Pa. App. filed July 28, 1909. Fuse resists tensile strains and includes a fuse wire and a combustion fibrous strand with greater tensile strength than the wire.

975,422. DISCONNECTING SWITCH FOR HIGH-POTENTIAL CIRCUITS; S. Q. Hayes, Pittsburg, Pa. App. filed Nov. 8, 1909. Includes a stationary contact, a pivoted lever above it, a movable contact suspended from its outer end and an interposed insulating structure, including a series of insulators one above the other, connected by linked connections.

975,424. BRUSH HOLDER; W. T. Hensley, Wilkinsburg, Pa. App. filed Nov. 8, 1907. A rod carrying a clamping ring with a notched surface, an arm rotating on the rod and a double spiral spring between the arm and the rod.

975,425. FIELD WINDING COIL FOR DYNAMO ELECTRIC MACHINES; W. T. Hensley, Wilkinsburg, Pa. App. filed March 9, 1908. A wedge-shaped coil with a plurality of single layer turns of conducting material of varying widths and uniform cross section.

975,421.—Circuit Breaker.

975,431. ELECTRIC CIRCUIT INTERRUPTER; R. P. Jackson, Wilkinsburg, Pa. App. filed Feb. 2, 1907. A switch arm pivoted to a stationary member and comprising an insulating tube, containing a fusible conductor which separates the tube from the contact when it fuses.

975,476. ARMATURE WINDING FOR DYNAMO ELECTRIC MACHINES; N. E. Storer, Pittsburg, Pa. App. filed Jan. 3, 1906. For alternating motors, including a slotted armature core containing the winding with high resistance conductors in the slots, a commutator, low resistance conductors arranged in two concentric rows and connected to the opposite ends of the high resistance conductors and to the armature and commutator segments.

975,477. ARMATURE WINDING FOR DYNAMO ELECTRIC MACHINES; N. W. Storer, Pittsburg, Pa. App. filed Jan. 3, 1906. A commutator cylinder with an armature winding, including groups of coils and resistance conductors for connecting the winding to the cylinder segments with strips of good heat conductors between the resistance conductors, but electrically insulated.

975,478. ARMATURE WINDING FOR DYNAMO ELECTRIC MACHINES; N. W. Storer, Pittsburg, Pa. App. filed March 2, 1908. An armature winding, a commutator with resistance conductors between the winding and the cylinder segments, having reduced end portions with means for increasing their conductivity.

975,490. VISUAL INDICATOR FOR KEY-OPERATED SWITCHES; J. J. Wesley, Hackensack, N. J. App. filed June 9, 1909. A wall switch, having a rocker to which stems are connected and a shutter operated by the movement of the parts which exposes the exterior of the switch.

975,504. TELEPHONE SYSTEM; C. C. Bradbury, Chicago, Ill. App. filed Oct. 16, 1907. Central energy system with simplified signaling apparatus at central, in which instead of using a cut-off relay energized between one side of the talking circuit and a third conductor with a second relay in series, the patentee uses a cord circuit with a single high resistance relay, which unbalances the line as little as possible.

975,529. SWITCH; W. Kaisling, Chicago, Ill. App. filed Feb. 6, 1909. Electrical switches for automatic telegraphy, including an arc-shaped bank of fixed contacts with a rotary concentric member, carrying a plurality of sets of wipers, each detachable as a unit from the member.

975,530. SWITCH; W. Kaisling, Chicago, Ill. App. filed Feb. 18, 1909. Selective switch for automatic telephones in which the wipers are adjusted in two intersecting plants with details relating to the mounting of the electromagnets which operate the switches, the pawl mechanism and the mechanical connectors for the circuit connections, etc.

975,533. STORE SERVICE CREDIT SYSTEM APPARATUS; C. F. Kettering, Dayton, O. App. filed Dec. 14, 1904. For quick investigation of the credit of customers while making purchases, including a telephone system with a marking device at the sending station, controlled from the receiving station through the medium of the message transmitting and signaling agencies.

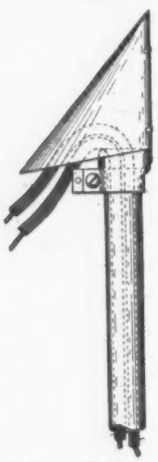
975,569. MULTIPLE FUSIBLE CUT-OUT FOR ELECTRICAL CIRCUITS; A. E. Partington, Sydney, New South Wales. App. filed May 6, 1910. Includes a revolvable barrel of non-conducting material consisting of two end disks, spaced by a tube, and separably held in their assembled condition by fastening means with fuses supported by the apertured end disks, having their metallic ends projecting beyond the barrel ends and contacts engaging the fuse ends.

975,571. ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE; H. N. Potter, New Rochelle, N. Y. App. filed July 1, 1905. Induces secondary currents within the body of the molten material and produces a rotating force upon the currents by maintaining an alternating rotating magnetic field in inducing relation thereto.

975,572. SYSTEM FOR MOTOR CONTROL; F. B. Rae, Boston, Mass. App. filed Feb. 18, 1910. A series motor with field coils wound in groups on each pole, the groups including different numbers of turns, and of different resistance with interpoles in series with the armature and the groups and the means for cutting out the groups successively to vary the field and interpole magnetization and armature current.

975,585. ELECTRIC CIRCUIT CONTROLLER FOR RAILWAY SWITCHES; G. M. Thompson, Seattle, Wash. App. filed May 18, 1909. An insulated housing, supported by the trolley wire which supports resilient contact plates and trolley guides, together with a magnetic track switch in circuit therewith, and closed by the trolley.

975,592. ELECTRIC CABLE JOINT; W. O. Wilson, Chicago, Ill. App. filed Aug. 16, 1909. Lead coverings for the cables with a lead jacket soldered to the coverings, a copper sleeve for the ends of the conductors and paraffin surrounding the sleeve, with paper surrounding the paraffin.



975,757.—Conduit Hood.

976,608. SWITCH FOR AUTOMATIC TELEPHONE SYSTEMS; A. H. Dyson, Chicago, Ill. App. filed July 5, 1907. Selective switch, including a plurality of groups of contacts, each constituting a self-contained and removable unit with adjustable contact devices and means for moving them, step by step, each step causing them to select a different unit, and means common to said units for holding them in fixed position.

975,650. LATERAL TROLLEY FOR ELECTRIC RAILWAYS; A. J. Steinweg, Chicago, Ill. App. filed April 1, 1907. Third rail system, in which the car has a shaft bearing in which the shaft rotates and can shift laterally and carries a trolley arm.

975,712. ELECTRIC HEATER; L. F. Parkhurst and H. G. Weeks, Binghamton, N. Y. App. filed Sept. 27, 1909. A base supporting a plurality of open flues with a heating element in each flue, consisting of a flat insulating material with an electrical resistance spirally wound thereon in double length, the terminals being at the same end of the element.

975,756. MULTIPLEX TELEGRAPH APPARATUS; S. D. Field, Stockbridge, Mass. App. March 25, 1910. Combines with a transmitter branch, an artificial line and a differential receiving instrument, a pair of transmitters, one in the main line, the other in the artificial line, the contact points of the transmitter being closed simultaneously.

975,757. CONDUIT-HOOD; L. A. Fleury, Jr., Indianapolis, Ind. App. filed Oct. 8, 1909. The hood has meeting ends, a shoulder and a collar all stamped from one sheet of metal.

975,777. ATTACHMENT FOR ELECTRICAL CONDUITS; A. McMurtrie, New York, N. Y. App. filed April 25, 1907. A plate through which an armature sheath conductor passes, which is attached thereto by means of a wedge to force the sheath in binding engagement with the opposite wall of the aperture.

975,794. ELECTRIC FURNACE WITH MAGNETICALLY ROTATED CHARGE; H. N. Potter, New Rochelle, N. Y. App. filed July 25, 1904. Produces a rotary magnetic field within a chamber for the molten metal, which is traversed by the induced current, thus stirring the metal.

975,823. LIGHTING FIXTURE; G. D. Beinert, New York, N. Y. App. filed Dec. 19, 1908. For use with gang work tables for sewing machines, etc., including junction boxes connected to each table with lamp brackets supported by each junction box and a conduit extending between the boxes.

975,835. PROCESS OF ELECTROLYTICALLY TREATING TANNIC INFUSIONS OF PLANTS; H. Damkohler and H. Schwindt, Bremen, Germany. App. filed June 16, 1909. Used in leather manufacture and includes a zinc container, an aluminum member connected therewith, forming a cathode, a porous cell, and an anode composed of zinc and aluminum, dipping into the cell.

975,845. WELDING METALLIC FILAMENTS FOR LEAD WIRES; K. Farkas, New York, N. Y. App. filed Oct. 4, 1909. Includes a supporting member for the stem carrying the filament, to which member an electrode is connected and a second electrode for forming the small fusing arc when the first electrode is close by.

975,875. ELECTRIC PLUG AND SOCKET; L. W. Kutsch, Chicago, Ill. App. filed Feb. 10, 1910. For theaters, including a forked wooden handle with porcelain between the forks carrying terminals, supports protecting the porcelain against injury.

975,879. DEVICE FOR TESTING ELECTRICAL APPARATUS; H. B. Lehman, Columbus, Ohio. App. filed June 6, 1910. For testing spark plugs and the like, including a handle carrying two angle arms with an insulating block between and sparking pins extending into the block.

975,885. ALKALINE BATTERY CONTAINING CHROMIUM AND MERCURY; W. Morrison, Des Moines, Ia. App. filed Nov. 22, 1909. A reversible alkaline battery, including an anode containing zinc and a chromium-oxygen compound.

975,909. THERMOSTAT; R. H. Waite, Denver, Col. App. filed June 16, 1909. Operates both at low and high temperature by the contraction and expansion of mercury contained in a vessel which will not leak vapor. The contact maker includes a resilient tube stretched by the force of the expanding fluid.

975,918. LOCK FOR SWITCHES; G. Wuelser, New Kensington, Pa. App. filed July 26, 1910. A plate with a casing, a partition therein, carrying a binding post, a binding post on the outside of the casing, a switch arm normally engaging the outer post, and which may extend into the casing to engage the inner post and rotatable locking disks within the casing to lock the arm in engagement with the binding post.

975,922. SWITCH SIGNAL; T. W. Adams, Collinwood, Ohio. App. filed March 2, 1910. An incandescent light at some distance from the switch which is illuminated when the switch points are operated.

975,933. TELEPHONE REPEATER; S. L. Campbell, Prairie City, Ore. App. filed Oct. 29, 1908. Includes a microphone at the sending end with a receiver at the receiving end, which actuates an armature operating a microphone, the receiving end also being provided with a transmitter, inductively related to a line leading to the original transmitting station, also including a receiver.

975,935. ARC LAMP; T. L. Carbone, Charlottenburg, Germany. App. filed March 19, 1909. Makes use of a globe for flaming arcs, divided into a plurality of superposed chambers, the middle chamber having a transparent wall surrounding the arc closely for preventing the gases from condensing on the walls.

975,936. COMBINED ELECTRIC IRON AND STOVE; B. R. Charles, Portland, Ore. App. filed Feb. 25, 1910. A supporting base with a handle which may carry the base below it to form an iron or above it to form a stove.

975,980. ALKALINE BATTERY; W. Morrison, Des Moines, Ia. App. filed Dec. 3, 1909. A positive electrode for reversible alkaline batteries, carrying a mechanically applied mixture of finely divided oxides of silver and mercury.

975,981. ELECTRODE FOR REVERSIBLE GALVANIC BATTERIES; W. Morrison, Des Moines, Ia. App. filed Oct. 10, 1910. The electrode has a central internal conductor about which the active material is held.

976,002. PRODUCTION OF LONG STABLE ELECTRIC ARCS; O. Schonherr and J. Hessberger, Ludwigshafen-on-the-Rhine, Germany. App. filed Jan. 10, 1907. The process of producing long stable electric arcs, side by side in a tube or passage provided with insulated electrodes, by passing currents of gas through the tube and causing the arcs to strike against one common electrode.

976,037. PROCESS OF TREATING VEGETABLE MATTER; G. D. Burton, Boston, Mass. App. filed Oct. 22, 1906. The vegetables are steeped in solutions and subjected to an electric current, producing gas, which passes through a condenser and is then collected for tanning purposes.

976,036. METHOD OF UNHAIRING AND TANNING HIDES OR SKINS; G. D. Burton, Boston, Mass. App. filed Sept. 9, 1904. Treats hides by first eliminating the oil by subjecting it to a current while immersed in an electrolyte, and finally placing them in a tanning solution and passing an electric current therethrough.

976,035. PROCESS OF WASHING CLOTHES; G. D. Burton, Boston, Mass. App. filed Oct. 12, 1906. Confines clothes in separate compartments of rotatable drum, containing water to which salt is added, and passes a current through the water, adds a soapy substance and again electrolyzes.

976,045. TREATMENT OF PRECIOUS METALLIFEROUS ORES; J. C. Clancy, New York, N. Y. App. filed May 13, 1910. Subjects the ore to the action of a solution containing a cyanogen in the presence of a halogen compound and electrolyzes the solution.

976,050. COMBINED TELEGRAPH AND TELEPHONE SYSTEM; E. R. Cunningham, Des Moines, Ia. App. filed Aug. 17, 1907. For telegraphing on an ordinary metallic telephone circuit by the use of power from a trolley circuit, an impedance connecting the two sides of the telephone circuit and a lead connecting the electrical center of the impedance with the groups, a telegraph receiver in the lead, a high-tension line wire, and a connection between the line wire and lead, including a sending key.

976,092. REVERSIBLE GALVANIC BATTERY; W. Morrison, Des Moines, Ia. App. filed Oct. 19, 1910. A reversible battery, including a negative electrode having an oxidizable metal and a chromium compound and a positive electrode containing silver and mercury and an alkaline electrolyte.

976,100. TERMINAL FASTENER; A. Schmidt, Flint, Mich. App. filed Feb. 7, 1910. A terminal stem with a groove, an eye receiving the stem and connected to a conductor, and a spring secured to the eye projecting into the opening to engage the groove.

976,111.—Wire Connector.

976,111. WIRE CONNECTOR; P. F. Williams, Chicago, Ill. App. filed Nov. 7, 1904. To avoid short-circuiting by the breakage of the overhead electrical conductor. The wire connector comprises two separable members, one having a hook with spring means for disengaging the hook when the connected wires are in their normal position.

976,123. SELECTIVE RINGING MEANS FOR TELEPHONE SYSTEMS; E. E. Clement, Washington, D. C. App. filed Jan. 18, 1907. Subscribers' lines terminate in different switchboards with a trunk line interconnecting them and an operator's apparatus connecting a calling line through the trunk with a called line terminating at the B switchboard, selective apparatus at the B-board, and actuating devices at the A-board controlled through the same trunk.

976,130. ALTERNATING-CURRENT CONTROLLING APPARATUS FOR HYDRAULIC ELEVATORS; D. L. Lindquist, Yonkers, N. Y. App. filed June 1, 1907. A multi-phase electromagnet having two sets of windings, with an armature intermediate to the sets, connection between the armature and the controlling mechanism, a phase splitting device between the alternating-current supply and the electromagnet and a selective system of circuits to determine the direction of movement of the armature.